Science, Nature and Beauty:

HARMONY AND COSMOLOGICAL PERSPECTIVES IN ISLAMIC SCIENCE

AN EXHIBIT AT THE RARE BOOK AND MANUSCRIPT LIBRARY | COLUMBIA UNIVERSITY LIBRARIES

OCTOBER 19, 2022 – MARCH 3, 2023

Preface

"*Science, Nature and Beauty: Harmony and Cosmological Perspectives in Islamic Science*" showcases over 90 manuscripts, instruments and objects from the Muslim World Manuscript collection housed in the Rare Book and Manuscript Library (RBML), at the Columbia University Libraries (CUL). This exhibit is a collective curatorial effort that has involved many students, faculty members, librarians and library staff working hand-in-hand over a period of fourteen months to exchange ideas and to select, research, engage with, and mount the items.

The impetus for the exhibit came from the realization that even a cursory look at CUL's collection of Islamic manuscripts and the Smith/Plimpton collection of scientific instruments reveals a few important facts. First, we were struck by the depth of collecting around Islamic science in our Muslim World Manuscript (MWM) collection at RBML. The foundational role of the MWM collection in the formation of RBML is rarely acknowledged, and the Smith Plimpton collections, which formed the core of the current Rare Book and Manuscript Library (founded in 1934) with unmatched strength in the history of Islamic science, have yet to be recognized. The fact that the diversity, uniqueness and depth of our Islamic manuscript holdings and the complex and diverse collecting that has occurred at our libraries throughout the decades is not always fully recognized and its various dimensions and aspects put in dialogue with one another seemed to us to constitute a call for action. The items in the collection demanded to be seen, engaged with, researched and appreciated: an exhibit focusing on Islamic science clearly constituted a great opportunity for scholarly learning and for active engagement with our collections, and for illuminating barely visible or suppressed chronological lineages and networks of scholarship, dialogue and exchanges not only in the history of science but also in the history of our own Library collections.

Second, these collections clearly challenge the traditional narrative of Islamic science as squeezed between mere transmission (of the Greco-Hellenistic heritage) and translation (into the European Renaissance). The items exhibited here help to bring into clear relief the complex and dynamic ways in which sciences permeated almost all aspects of life within the Muslim worlds, not only during the so-called "golden age" or "classical" centuries of Islamic history but up until at least the middle of the 18th century. These collections contribute to an understanding of Islamic science as a robust, diverse and lively scholarly endeavor that touched on many aspects of the Muslim world, and as a central and non-reducible component of larger and non-linear histories, cultures and traditions of the arts and sciences.

The conclusion we drew was that such an exhibit would constitute a wonderful opportunity to address those silences and gaps; to enrich the history of science from a non-Western standpoint; to establish a precedent to use exhibits as a collaborative learning and critical teaching tool, one that is grounded in an intellectual discipline and a subject, beyond mere "show and tell" visual exhibits. We conceived this exhibit as a learning, collaborative journey, one that we hoped would involve many voices and players, diverse and different, but always united through a great scholarly companionship, a *suhba* (companionship) of scholars in search of the joy of learning.

We met fortnightly for the better part of the year to go through the many items that our team of students, fellows, librarians and faculty researched, wrote about and presented during our collective discussions. The result is a narrative and curatorial framework that reflects our *collective* work. We have arranged the items on display into 10 cases (and one case with some curatorial statements and testimonies) in RBML and into the various sections of the brochure, in accordance with the following broad themes, as follows: Knowledge and Practice; Cosmographies and Wonders of the World; Keeping Time: in Synchrony with the Heavens; Teaching, Pedagogy and *Adab*; Euclid; Islamic Astronomy and Astrology; Mathematical Sciences; the Occult Sciences; Beyond Illustration: *Adab* and Ways of Seeing; Beyond the Text: Calligraphy as a contrapuntal, devotional and scientific art.

We hope that our narrative framework brings into focus a conception of scientific practice within Islamic societies as fundamentally a matter of contemplation, harmony and attunement with the universe, rather than of control and power over nature and resources. Equally, we hope the exhibit will provide its audience with a historical view of Islamic societies as permeated by science at every level: science ends up informing everything from daily calendars and prayer times calculated across multiple latitudes, intricate knowledge of the skies and the planets, architecture and grand monuments laid to precise mathematical and exquisite geometric patterns of arabesques and mosaics, to pocket astrolabes that help navigate the world. A scholar of Islamic science once jokingly said to me that the astrolabe, popularized by Islamic scientists on unprecedented scales, is the ancient equivalent of the smartphone! Perhaps this exhibit will help to reveal the truth of this remark.

Kaoukab Chebaro
Global Studies, Head
Columbia University Libraries

Acknowledgments

The making of this exhibit required the collaboration of a very broad range of players, across various units at the University Libraries and various Institutes and Departments at the University. It involved students, faculty members, librarians, conservators, digital experts, designers, each bringing a very broad range of expertise. The people who made this exhibit possible are too numerous to acknowledge here: not least of which because it is always hard to draw a clear line for the beginning of a collection, or of engagement with a collection.

Our curatorial team consisted of the following members: Kaoukab Chebaro (Global Studies, Columbia University Libraries), Olivia Clemens (PhD candidate, Art history Department), Aneka Kazlyna (graduate student, MESAAS), Arwa Palanpurwala (Islamic Studies MA Student, Middle East Institute- GSAS,), Prof. A. Tunç Şen (History Department), Prof. Marwa El-Shakry (History Department), Prof. Avinoam Shalem (Reggio professor, Art History Department), Julia Tomasson (PhD candidate, History Department), Yusuf Umrethwala (Islamic Studies, MA Student, Middle East Institute- GSAS), and Navid Zarrinnal (PhD graduate, MESAAS).

- Window One was co-curated by Prof. A. Tunç Şen, Prof. Marwa el-Shakry and Kaoukab Chebaro;
- Windows Two and Three were co-curated by Yusuf Umrethwala and Kaoukab Chebaro;
- Window Four was co-curated by Kaoukab Chebaro and Navid Zarinnal;
- WIndow Five was curated by Julia Tomasson;
- WIndow Six was curated by Aneka Kazlyna;
- Window Seven was co-curated by Aneka and Julia;
- Window Eight was curated by A. Tunç Şen with support from Kaoukab Chebaro;
- Windows Nine and Ten were co-curated by Kaoukab Chebaro, Olivia Clemens, and Arwa Palanpurwala, with advice from Avinoam Shalem.

Everyone reviewed everyone else's work, and contributed ideas, suggestions and revisions.

We thank the Columbia University Libraries for the opportunity to engage with our collections, particularly: **Courtney Chartier** the Director of RBML; **Pamela Graham**, the Director of Humanities and Global Studies; **Jennifer B. Lee** (Curator of Performing Arts Collections, RBML); **Vanessa Lee** (Public Services Specialist, RBML); the staff of the Conservation and Preservation Unit at CUL (special thanks go to **Alexis Hagadorn**, **Nathalie Naor** and **Emily Lynch**), and to all the members of the team who made the digitization of the Muslim World Manuscript collections possible in the past few years, and opened up access to our collections in unprecedented ways (Emily Holmes and her team). Many thanks also go to **Peter Magierski**, the Middle East and Islamic Studies Librarian for his support throughout. Final thanks go to the **Middle East Institute**, to the **Sakıp Sabancı Center for Turkish Studies**, to the **Art History Department**, to the **Center for the Study of Muslim Societies**, and to the **Center for Science and Society** for their generous support for this brochure and for the exhibit.

Kaoukab Chebaro

This exhibit is dedicated to all students, young and old,
lovers of Islamic material culture and of stories awaiting to be told.

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X892.8 N651, Folio Khamsah, Niẓāmī Ganjavī, 1140 or 1141-1202 or 1203/ Illustration from Majnun va Layli, 16--? Iran?, FOL. 141V

Introduction: Knowledge and Practice

"There is no other concept that has been operative as a determinant of Muslim civilization in all aspects to the same extent as* ʿilm *[knowledge]".

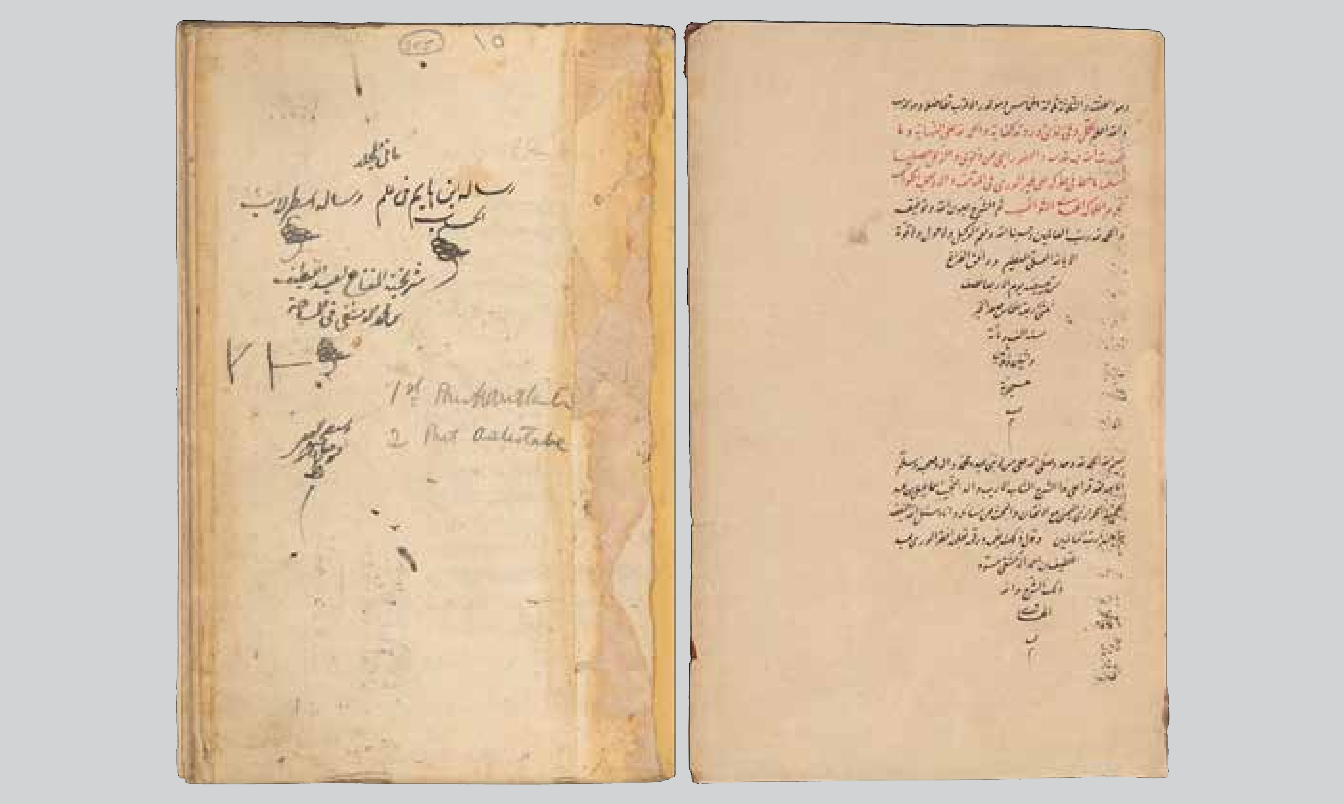
Franz Rosenthal, *Knowledge Triumphant: The Concept of Knowledge in Medieval Islam*

Muslim scholars attached a great weight to the value and development of knowledge, and it is fair to say with Rosenthal that *ʿilm* [knowledge], its pursuit and propagation, defined many aspects of Islamic societies across locations and eras. Over extended periods of time and across a multitude of cultural contexts, the conceptualization and classification as well as the pursuit of knowledge were fostered by some fundamental beliefs undergirding the new faith, namely the view that God's creatures—small or big, including humans as one component of a vast, harmonious and dynamic universe—all lead to knowledge of God. This worldview nurtured a vibrant curiosity and sense of awe at the world, which permeated every possible aspect of inquiry. ʿIlm was ultimately concerned with understanding God's *āyats*, his signs and creations in the world, and of man's place in the cosmos. Seeking and transmitting knowledge was a vital public good and a religious duty. A vibrant, diverse and dynamic system of scholarly exchange and scientific inquiry flourished throughout the Islamic worlds: religious sciences (e.g., shariah, *fiqh* and *kalām*) as well as literary and linguistic ones (*adab*, rhetoric, grammar, logic), "exact" and "applied" sciences all flourished side by side and fed one another. An astounding curiosity, humility, vibrancy and connectedness animated the outlook of scholars who traveled far and wide in search of a teacher, or of knowledge, leaving their lands, families, possessions, and familiar surroundings behind.

Schools and libraries sponsored by political elites proliferated and were the showpieces of a power and a culture on the rise; but far more extensive and impactful were the myriad new learning structures and circles, impressive not only for their expertise, versatility, and focus on specific subjects, but also for their widespread accessibility through local mosques. Students at *madrasas* (Islamic colleges) could get full boarding in the *khans* (inns) adjacent to them, and were not typically charged any tuition. Private support through endowments (*awqāf*) also played an important role in providing support for various learning circles and institutions, and indeed became the backbone of this extensive scholarly network. Women as well as men competed in participating in the pious act of supporting learning through *awqāfs*, and patrons could endow land, construct a building for the purpose of learning, fund the expenses of a chair within a *ḥalaqa*, the boarding of students at a *madrasa, or even* an entire library, or just an individual manuscript.

The evolution of the *madrasa* from the eleventh century saw the elaboration of a set of complex rules and requirements governing the awarding of certificates (*ijāza*) of audition, of reading, of copying, of writing to students upon the fulfillment of clear curricular and behavioral demands. Scholarly works arising out of this system proliferated through a series of commentaries and glosses, as well as abridgment or expansion, and the traces and notes left in the margins of manuscripts to testify to this multi-authorial practice complicate our modern, Western notions of authorship.

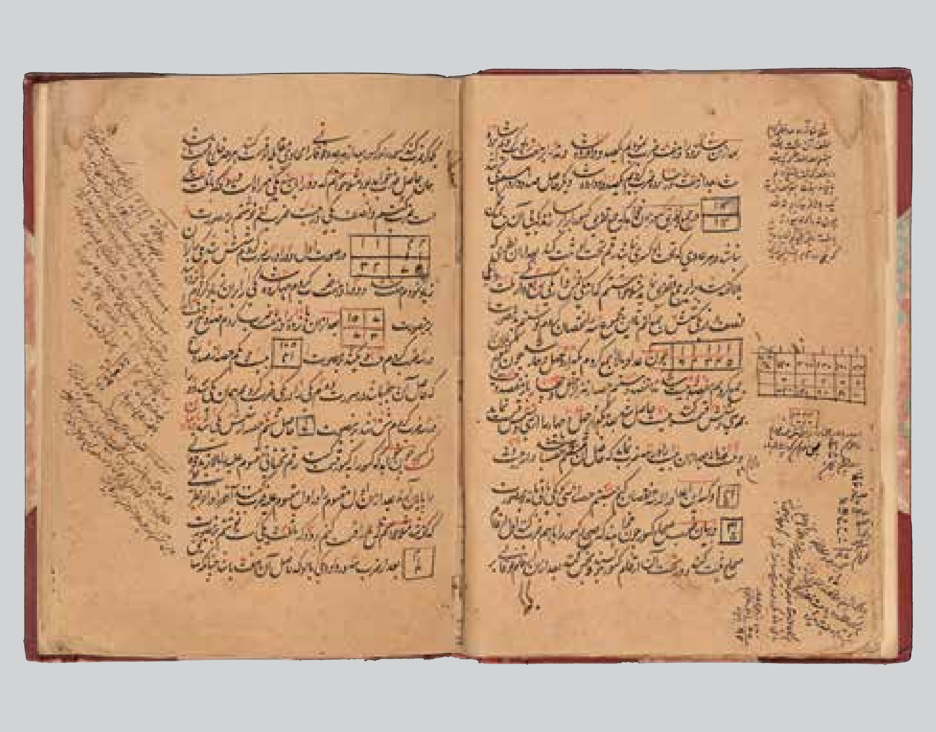
Extensive traces of appreciation for books and learning abound in the works on display here through various inscriptions, ownership and endowment notes inside the pages of a manuscript. Colophons typically record the dedication of the copying of a manuscript as a pious act, and identify the copy, in typical fashion as having been completed by "the humble, poor, dedicated servant of God" on a specific date/place. The teacher/student relation played a central role in undergirding a vibrant system of transmission, and the sciences held an organic relation with the religion and the cultural outlook created in the Islamic worlds, as a path towards contemplation (rather than power), understanding and harmony (rather than control). Knowledge (*ʿilm*), and its findings permeated almost every aspect of daily life, from astrolabes which functioned as mini smartphones to intricate and exquisite geometric patterns which adorned everyday objects: this was a society well attuned to, and imbued with science.



MS Or 305, Hādhihi risālah fī al-ḥisāb …,Three treatises in different hands, bound together. The first is an abridgement of Ibn al-Bannā'’s Talkhīṣ by Ibn al-Hā'im. The second is a short work on astrolabe terminology and use. The third appears to be a copy of Sharḥ mukhtaṣar al-Tuffāḥah fī ʿilm al-misāḥah by ʿAbd al-Laṭīf ibn Aḥmad al-Dimashqī, Turkey, 1719-1720, RBML

Among the traces of authors, students, copyists, and readers of manuscripts in the Muslim world, certificates of audition or readership (*ijāzat al-samāʿ*, *ijāzat al-qirāʾah*) have a special place. These short notes located typically at the end of treatises demonstrate that the student(s) mentioned in the note had studied (audited) the work under the direction of the author or an authorized person (with the chain of transmitters/teachers ultimately going back to the author). The certificates of audition are considered to have appeared in the 11th century after the emergence and development of the madrasa as a novel institutional form of learning and education.

The folio exhibited here is taken from a compilation (*majmūʿa*) that contains three separate treatises: the first on arithmetic, the second on the use of the astrolabe, and the third one on the science of measurement (*misāḥa*) entitled *Sharḥ Nukhbat al-tuffāḥa fī ʿilm al-misāḥa* (*Commentary on the Best of the Apple in the Science of Measurement*). Seemingly an autograph copy of its author, *ʿAbd al-laṭīf b. Aḥmad al-Dimashqī* (d. 1749), the treatise is concluded by an audition certificate, tracing its study back to the author's father.



MS Or 38, Bhāskarācārya, Līlāvati, (Lilavati exercises), Abū al-Fayẓ ibn Mubārak Fayẓī's (d. 1595) translation of Bhāskarācārya's Sanskrit work on arithmetic & masāḥa (copied in Lahore in 1721), RBML

This original work was written in 1150 for Līlāvātī, Bhāskara's daughter, and the work is named after her. In fact, many of the mathematical problems included are addressed to her. The story goes that Bhāskarācārya studied Līlāvatī's horoscope, which predicted she would die childless and unmarried. Attempting to cheat fate, he predicted an auspicious time for her to marry and arranged a cup with a small hole in it to slowly fill with water, to alert her to the precise moment she should marry. Curious, Līlāvatī examined the contraption, but while doing so, a pearl fell from her wedding dress into the water thereby ruining the timer. Distraught, he dedicated this work to her to ensure that she would have a legacy of another kind. Notice the marginalia in this well used work, a testimony to long lasting, and wide ranging student/teacher relationships.

Audition, reading or studying/copying certificates recorded within the pages of a manuscript often provide clear evidence as to how books or certain parts of texts were used in study and scholarly gatherings (*majālis*), or study circles (*ḥalaqa*), which often took place at mosques. Audition certificates suggest that works were read in a collective manner, and point out the existence of oral paths to learning besides scribal ones.

On display here are parts of Ibn ʿAsākir's (d. 1176) colossal account of the *History of Damascus* (*Taʾrīkh madīnat Dimashq*), which is a compendium of anecdotes regarding the life and events of significant figures living in or visiting the greater Damascus area. Though undated, transmission notes inserted at the end of each section (*juz*) place the copy in the 12th century. For instance, the first transmission note on 20r states that the copy was read on 21 Rabīʿ al-awwal 536 (31 October 1141) in the Great Umayyad Mosque of Damascus, some thirty years after the death of he author, making the study of this copy almost contemporaneous with the life of the author, and providing additional evidence—besides the content of Ibn ʿAsākir's History of Damascus at hand, regarding the importance of Damascus as a city of great learning in the 12th c., one which was truly cosmopolitan in nature, attracting scholars from all over the Islamic empire.

MS X893.7 Ib66, Ibn 'Asākir, 'Alī ibn al-Ḥasan, al-Juz'... min kitāb Tārīkh madīnat Dimashq, 1141, RBML, Purchased in Cairo by Richard Gottheil through the Alexander I. Cotheal fund in 1896 (note in pencil laid in and library bookplate inside front cover).

MS X893.7 K845, [al-Qurʿān], 9th c., Fine Kufic manuscript, Parchment; 225 x 344 (200 x 290) mm, bound to 225 x 365 x 33 mm., containing the last word of verse 26:2 ([a]l-mubīn) to the penultimate word of 36:32 (ladaynā). Includes red-dot vocalization. Combines features of Déroche's script styles D.I and D. IV, suggesting a mid-9th to mid-10th century date. Rebound in the early modern period, RBML

This beautiful Kufic 9th c. Quran shows typical features of the undotted kufic script: elongated letters (which some scholars argue is a response to the rectangular page format), in a dark black ink that seems to have been retouched or amazingly preserved. The Qur'an abounds with verses which encourage and laud learning and the quest for knowledge. A few examples include:

Q 2:31: وَعَلَّمَ آدَمَ الْأَسْمَاءَ كُلَّهَا ثُمَّ عَرَضَهُمْ عَلَى الْمَلَائِكَةِ فَقَالَ أَنبِئُونِي بِأَسْمَاءِ هَٰؤُلَاءِ إِن كُنتُمْ صَادِقِينَ

Q 2:31: "And He taught Adam the names—all of them. Then He showed them to the angels and said, "Inform Me of the names of these, if you are truthful."

Q 3:79: "Be pious scholars of the Lord because of what you have taught of the Scripture and because of what you have studied."

Manuscripts travel across ages and pass in different hands, which often reveal their identities on the front endpaper to indicate ownership. These ownership statements and *waqf* (endowment) records or seals are indispensable sources to track the provenance and life stories of volumes. The ownership statements vary from the simple ex libris (*min kutub*) to detailed inscriptions elaborately inserted in roundels and medallions. Besides the owner's name or the date when the copy was acquired, these notes may reveal invaluable information about the sites and networks of intellectual production. In this Turkish volume, for instance, which was composed by a certain Ibrāhīm Efendi in the late eighteenth century, there is an elaborate ownership statement documenting that the book was obtained by a certain Dervish Aḥmed in the year 1234 AH (1818 or 1819), who, as the note reveals, was a member of the Sunbuliyya Sufi order in the Merkez Efendi lodge in Istanbul. Right below this note is located another one, stating that he later donated the volume in December 1820 to the disciples in the same lodge through a *waqf*, extricating it from any commercial use for the benefit of a pious act of learning.

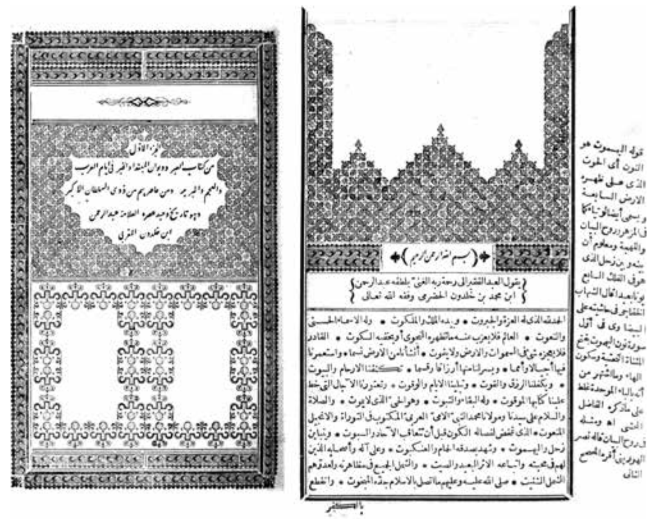
UTS Ms. Tur. 3, Ibrahim Efendi, Dîvân-i Kutb al-arifin, 1792, Copy completed by Dervīş Ebūbekir b. ʿOsmān on 9 Shaban 1206 (2 April 1792), Union Theological Library (UTS), Burke

MS Or 42, Shinshawrī, ʻAbd Allāh ibn Muḥammad, Bughyat al-rāghib bi sharhi murshid al-tālib /[Damascus?], [16—or 17--], RBML

This is a commentary on Ibn al-Hā’im’s treatise on arithmetic. The original text is written in red ink, while the commentary is in black. The original copy of the commentary was composed in 995 AH. This copy was probably written in the 12th century AH according to the *Ijāza* section in the first page of the manuscript. Collation of the original text with a commentary as a model of education and critical learning was one of the principal ways of ensuring an authoritative transmission of texts in the scribal cultures of the Islamic world: supercommentaries with the original text appearing alongside the commentary abound. A “muqabalah” note (comparison note) can be seen on the page on display here.

MS or 360, Nevʿî, Natā’ij al-funūn wa-maḥāsin al-mutūn, Late-16th century example in the genre of encyclopedias/classification of sciences, 1623. RBML

Encyclopedias and classification of the sciences flourished as a distinctive genre in Islamic intellectual history. Handling the immense number of scholarly and literary disciplines, the classification of science books had immense pedagogical functions and helped their readers gain a clear understanding of objectives, methods, and essential texts to be read in a given discipline. Just as there were multiple branches of knowledge, so were there different classification systems and styles used by different compilers of sciences. Abundantly available in Arabic, Persian, and Turkish from the tenth century on, the classification of science books offer modern readers strong insights into how learning and books were conceived in the Muslim society. The volume exhibited here is an early seventeenth-century copy of a popular Ottoman encyclopedia penned by an esteemed scholar in the late sixteenth century. Besides treating fourteen branches of knowledge, from history and philosophy to astrology and dream interpretation, the copy stands out for the extensive *minhu* records in its marginalia, which, as pre-modern “footnotes,” are traced back to the original author of the text.



893.713 Ib3, Muḥammad ibn Khaldūn al-Ḥaḍramī (1332–1406), Kitāb al-ʻibar wa-dīwān al-mubtada’ wa-al-khabar fī ayām al-ʻArab wa-al-ʻAjam , 1867. RBML

Abū Zayd ‘Abd ar-Raḥmān ibn Muḥammad ibn Khaldūn (1332-1406) was a polymath and scholar born at a time of major social and political upheavals that followed the Mongol invasions after the Siege of Baghdad and the series of plague outbreaks which critically decimated the world’s human populations. Over a long career, Ibn Khaldun served in a variety of scholarly and administrative posts, moving from Tunis, Fez and Granada to Damascus and Cairo. Following in the footsteps of universal histories of the kind composed by Mas’udi and others, Ibn Khaldun’s *Kitāb al-‘Ibar wa-Dīwān al-Mubtada’ wa-l-Khabar fī Ta’rīkh al-‘Arab wa-l-Barbar wa-Man ‘Āṣarahum min Dhawī ash-Sha’n al-Akbār* “Book of Lessons, Record of Beginnings and Events in the History of the Arabs and the “Berbers” and Their Powerful Contemporaries” was an attempt to do just this. The *Kitab* was divided into 7 books: an introduction, or the Muqaddimah, three volumes on world history, and 2 volumes on the Amazigh and the Maghreb. As seen in the first page of the table of contents in this nineteenth century reprint, the *Muqaddima* moves from a discussion of "human civilization" in general (including the effect of different climatic zones on human habitation) to an exploration of the role of political dynasties and governments, along with their cities and arts and sciences. And while the work has been hailed by many modern scholars as quite "modernist" in its seemingly "sociological" perspective on history, civilization and culture, Ibn Khaldun's full table of contents, even just for the Muqaddimah, demonstrates a broader conception of the arts and sciences than his later admirers might have acknowledged, including soothsaying, divination and many of the other occult sciences exhibited in these windows (especially Window VIII).

While most people only read the Muqaddimah today, Ibn Khaldun's vast enterprise was arguably better read after the seventeenth century when Ottoman officials and then, after the nineteenth century in particular, European orientalists revived an interest in the work. Much of this interest was propelled by the renewed interest in the history of "civilizations", a concept that was also being radically revived after the nineteenth century. Much as Ibn Khaldun had done in the Muqaddimah itself, the idea of "civilization" was then also critically re-oriented around a discussion of what the modernists would dub the "universal progress of the arts and science."

MS Or 201, [al-Qurʿān], Complete late Ottoman muṣḥaf, layout: 15 lines per page.;Script: Naskh.; Decoration: Stippled gilt double-page frontispiece (following 1b-2a) and finispiece (following 360b-361a)^Marginal verse markers^Occasional floral sprays; Gilt fore-edge, [Turkey?], 1781-82. RBML

Verse 96:4-5: (الَّذِي عَلَّمَ بِالْقَلَمِ) (عَلَّمَ الْإِنسَانَ مَا لَمْ يَعْلَمْ)

Who taught by the pen … Taught man that which he knew not.

MS Or 265, Athīr al-Dīn al-Abharī, al-Mufaḍḍal ibn ʻUmar, Īsāghūjī, [Turkey?], 1786. RBML

This is a copy of al-Abharī's famous commentary on Porphyry's *Isagoge, a foundational work on logic*. The text is heavily marginalized by another scholar. Two of the folios of the manuscript are paper slips attached to the rest of the text. Based on the name and title of the scribe it seems the manuscript was produced somewhere in the Ottoman Empire.

Abharī', sometimes referred to as "Athīr al-Dīn al-Munajjim" (the astrologer), was a well-known philosopher who wrote influential texts in logic, mathematics, and astronomy. Among his students were the famous historian Ibn Khallikān, the philosopher Najm al-Dīn al-Kātibī, and Shams al-Dīn Muḥammad al-Iṣfahānī. He also corresponded with the cosmologist ʿImād al-Dīn Zakariyyā ibn Maḥmūd al-Qazwīnī and the famous astronomer and polymath Nasir el Din al Tusi. Abharī's independent astronomical works include treatises on the astrolabe, commentaries on earlier *zīj*es (astronomical handbooks with tables), and compendia on astronomy. Abharī wrote several mathematical works, including a "Correction" (*Iṣlāḥ*) of Euclid. (reference: Al-Abharī, Athīr al-Dīn (2001). *Kashf al-ḥaqāʾiq fī taḥrīr al-daqāʾiq*, edited by H. Sarıoğlu. Istanbul.)

Sphere, bronze with stars in silver. Persian, dated 1055 AH. Inscribed by the maker, the grandson of al-Hadded who was chief astronomer under Humāyūn—Ḍīyāʾ al-Dīn Muḥammad b. Qāʾim Muḥammad b. ʿĪsā b. al-Hadded, 2nd Mughal Emperor (1508-1556). The globe is inscribed with pictorial depictions of the twelve zodiac constellations and the main stars are marked with dots filled with silver and are numbered. Some other Ptolemaic constellations like Cetus (sea monster) and Eridanus (river) are also inscribed. The circular stand around the globe has Greek zodiac signs and Arabic alphabets inscribed in the form of a scale. A depiction of a building is also visible on the globe, most probably representing the Prophet's Mosque in Medina. A noteworthy feature of this globe is the precision in which the inscriptions of the figurative zodiac signs have been executed which is testimony to the exemplary craftsmanship of the Mughal period.

Celestial Globe, Lahore, signed by [Ḍīyāʾ al-Dīn Muḥammad b. Qāʾim Muḥammad b. ʿĪsā b. al-Hadded], 1055 H, [1645 C.E.]. Smith Instruments 27-198. Gift of David Eugene Smith. (Personal Images)

The three types of globes made prior to the 19th century were: terrestrial, detailing the geographical and other characteristics of the earth; celestial, depicting the appearance of the geocentric vault of the heavens; and globes that display the physical features of other celestial bodies, such as the moon. David Eugene Smith collected only celestial globes, such as the one shown here.

The oldest known celestial globe, the "Atlante Farnese" in the Naples Museum, appears to follow the codification of ancient astronomy and geography made by the Alexandrian scholar Claudius Ptolemy around 150 C E. It shows the outline of the constellations against a coordinate system. In China, Ho-shing-tien made a celestial globe around 450 C E, and Arabic astronomers were using examples from about 1050 C E.

Islamic celestial globes differed from the models of Ptolemy in that they depicted the figures of the constellations facing outward, toward the viewer, rather than inward toward the center of the globe. (See, Sarma, Sreeramula Rajeswara (1994). "The Lahore family of Astrolabists and their Ouvrage". *Proceedings of the Indian History Congress*. **55**: 287–302. JSTOR 44143367). ❖

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Cosmographies and Wonders of the World

"He is Allah, al-Khāliq (the Creator), al-Bāriʾ(the Inventor), al-Muṣawwir (the Shaper, Giver of forms); to Him belong the most beautiful names. Whatever is in the heavens and the earth glorifies Him." (Quran 59:21-24)

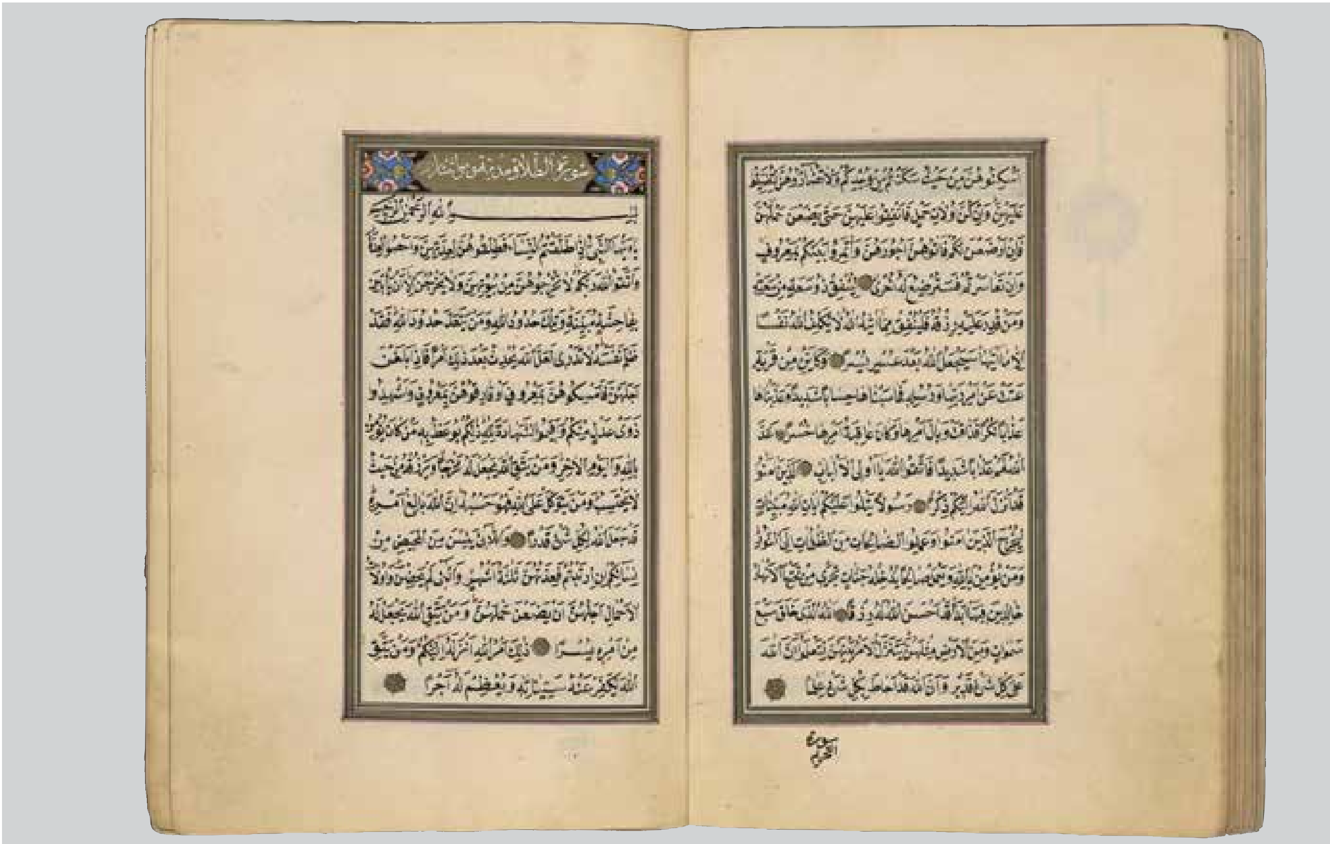
"There are more things in Heaven and Earth, Horatio, than are dreamt of in your philosophy." —Shakespeare, *Hamlet*

Islam emerged in a society which was deeply invested in understanding the cosmos, and was well acquainted with the stars and skies: knowledge of the 'science of the stars/the cosmos' was important for various people in the Arabian peninsula who relied upon the stars and skies for navigation and orientation on their journeys. Some also used the stars to predict the future or derive omens, and indeed, celestial bodies were commonly worshiped as originators of the world, a practice later strongly discouraged by Islam. Islamic thinkers' involvement with cosmography and cosmology (the origin, nature and order of the universe) also grew out of their familiarity with and critical embrace of the heritage of Classical Greece: the early translation of Aristotle's *Metaphysics* and Ptolemy's *Almagest* into Arabic were perhaps foremost in kindling cosmographic inquiries into the nature of matter, substance, and the cosmos. However, it is fair to say that the greatest impetus to compose new cosmographies came from injunctions of the new faith.

The Qur'ānic scripture repeatedly lauds the contemplation of and inquiry into God's creations (including the cosmos, the heavens, stars, nature, animals, rocks, and indeed the human soul and body) as a pious act. The Quran invites believers to marvel at the cosmos and at God's creations, to travel far and wide, to study the world's creatures, small and large and to inquire about its wonders (*ʿajāʾib*), mysteries and peculiarities (*gharāʾib*).

Islamic cosmological views and doctrines hold that the cosmos or universe (*al-ʿālam*)—the entire created order (*al-khalq*) or *kawn*, (which is related etymologically to the word *kun* [Be!])—is the realm of an engendered existence. Cosmology, or *ʿilm al-kawn*, examines "everything other than *Allah*", which the Quran refers to as "everything in the heavens and the earth." Muslim scholars rejected the view of an anthropocentric world and believed in a hierarchical plurality of beings. Across the variations of cosmologies produced by scholars and philosophers, the view of the universe as dynamic, and of all creatures bearing teleological and relational influences to each other predominates. The common, the visible, the observable as well as the strange, the wondrous, the psychological and the metaphysical, all presented pathways to attain insight into the larger whole and into the Unity of God, so that *ʿilm* can "make the invisible visible".

The manuscripts on display here evidence the tremendous curiosity and creativity that drove these cosmographic inquiries. The items on view speak of *ʿajāʾib* (wonders) and *gharāʾib* (peculiarities), of spirits of the unseen world (*rijāl al-ghayb*), of planets and their influence on earth, of the structure of the Universe (*shakl al-ʿālam*), of ominous times when forces conflate, of distant geographies and histories, and of worlds beyond imagination and understanding. They all cry out for explanation, arouse human curiosity and create a sense of "wonder", i.e., *taʿjjub*, and awe as a path towards science, understanding and contemplation.



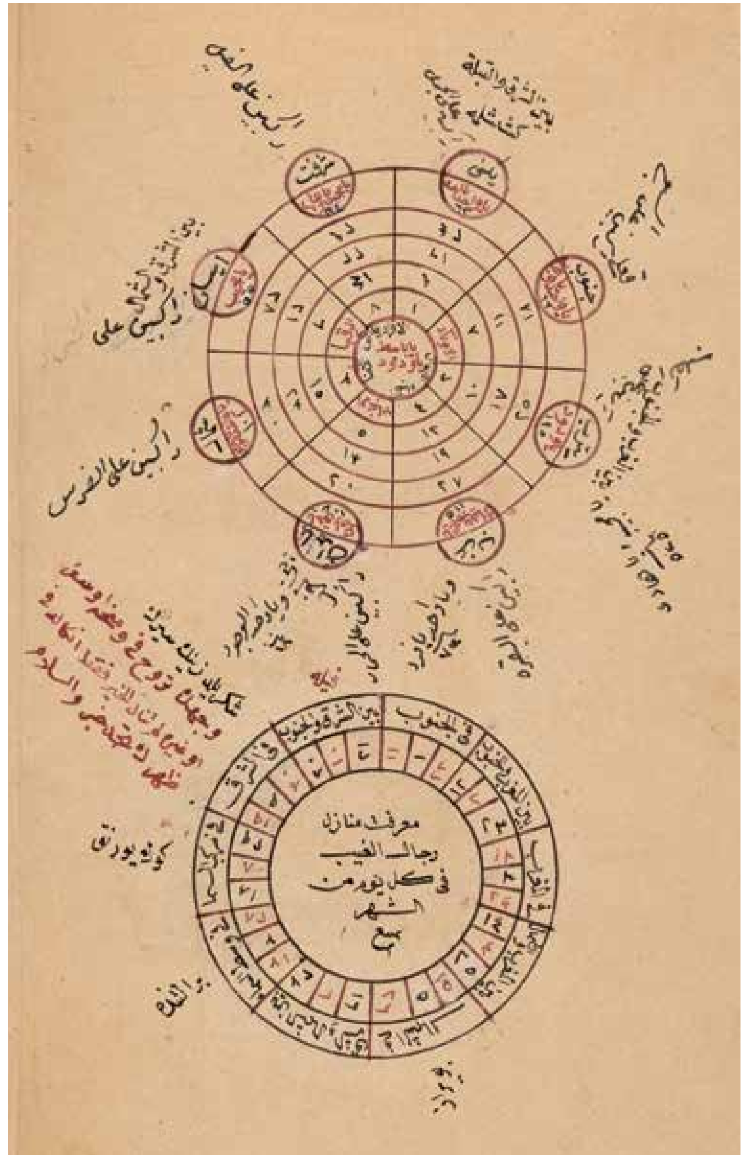
MS Or 179, *al-Qur'ān*, [Unknown place of copying], [between 1700 and 1850?]. RBML, Gift of David Eugene Smith, 1931–1934.

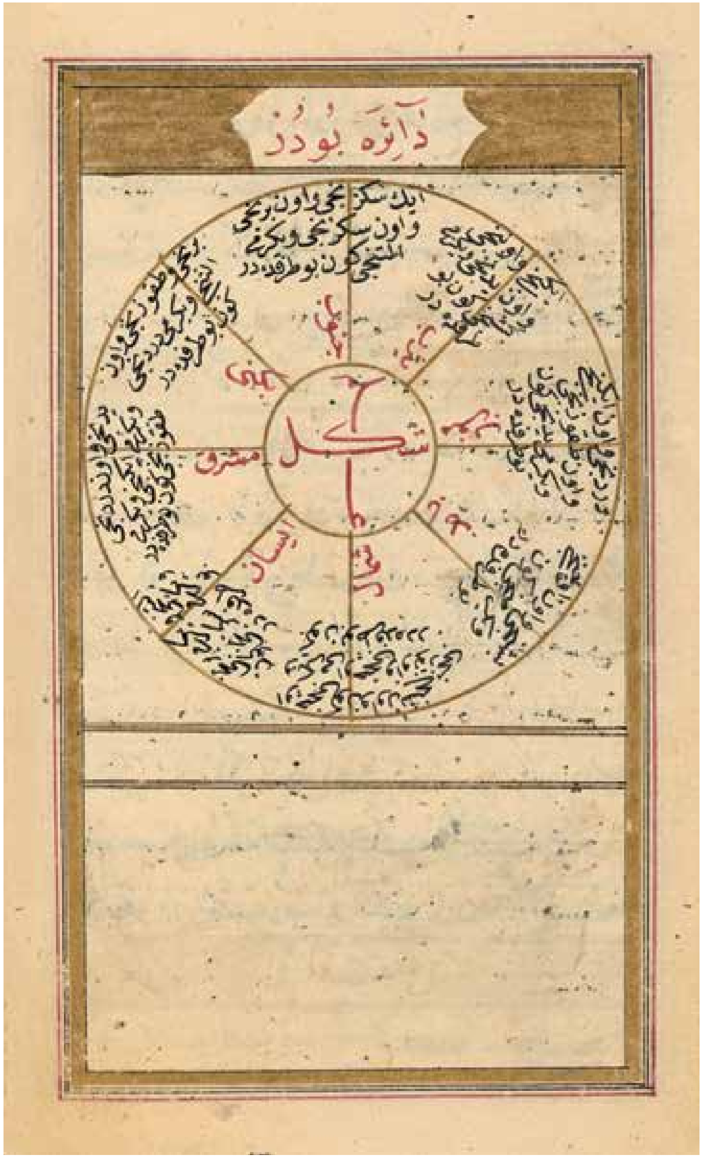
The Qur'ānic scripture contains several references to cosmic elements, e.g., God's *ʿarsh* (throne), *kursī* (chair), *qalam* (pen), *lawḥ māḥfūẓ* (tablet), *sabʿ samāwāt* (seven heavens), *malāʾika* (angels), *jinn* (spirits), etc. The Qur'ān underscores the existence of multiple worlds (*rabb al-ʿālamīn*, Allah as Lord of all Worlds) and their coexistence in a hierarchical order of harmony. The last *ʾāyah* (verse) on the verso page of the Qur'ān on display here translates as follows:

"Allah is the One Who created seven heavens (in layers), and likewise for the earth. The divine command descends between them so you may know that Allah is Most Capable of everything and that Allah certainly encompasses all things in (His) knowledge." (Q:65:12)

A book of prayers in Arabic, with instructions in Ottoman Turkish. The sciences of alphabetical symbolism, astrology, and alchemy are closely related to cosmological explanations. The two diagrams on display here are about *rijāl al-ghayb* (saintly spirits of the invisible world). They indicate the direction and time of day at which the saintly spirits will appear, and at which perspicuous times engaging in prayers would gain the saints' intercession and achieve success for the believer's wishes and *duʿāʾ* (prayers). The top diagram is divided into eight parts, and the small circles on the outermost concentric circle depict eight directions for the wind, with different names of God written in red. The script in black situated outside and parallel to the small circles suggests the direction in which one must travel and the animal on which one must ride in order to have the spirits intercede in one's favor. (The animals mentioned are: elephant, horse, camel, cow, donkey, mule, and fox.) The second diagram is divided into two layers. The outer circle is divided into nine directions: (from the top to the left) north, northeast, the center of the sky (*markab al-samāʾ*)—the direction opposite middle of the sky which indicates the time of midnight prayers (*niṣf al-layl*), middle of the sky (*wasaṭ al-samāʾ*), southeast, south, southwest, west, and northwest. The second level and inner circle is divided into thirty parts, each representing a day of the month. The use of this diagram is to indicate the direction in which spirits will appear on particular days of a month, for example, on the 9th, 19th and 30th days of the month, the spirits will appear in the east. The innermost circle bears the name of the diagram, "*maʿrifat manāzil rijāl al-ghayb fī kull yawm min al-shahr*", which translates into: "Learning the positions of the hidden spirits on each day of the month".

MS Or 131, [*Collection of Prayers*], [Turkey?], [between 1725 and 1825?]. RBML, Gift of David Eugene Smith, 1931–1934.





This work is a *majmūʾa*, a collection of Sufi writings and prayers, produced inTurkey probably, [1797] by a number of authors, including: ʿAbd l-Qādir al-Jīlānī, Ṣadr al-Dīn al-Qūnawī, Muḥammad b. Isḥāq, an others.

The second work in this *majmuʿa* (compilation) on display here contains prayers attributed to Abū l-Ḥasan ʿAlī al-Shādhilī (approximately 1196–1258) with additional prayers and some religious poetry included at the end of the second section. It is in the genre of *Rijāl al-Ghayb* (men/saints of the unseen world), a theory that originated in some Sufi circles. The work depicts a diagram which spells out when and where the hidden spirits would appear. Here the circle is divided into eight parts, representing eight directions of the wind, with the title: *shakl al-ʿālam* (Structure of the Universe) written at its center. The diagram is followed by brief advice urging the reader to know from which direction/angle and at what time the hidden spirits would appear, thus enabling the reader/believer to recite the appropriate prayer and see their aspirations/wishes fulfilled. The note states that "this method and the prayers have been tested numerous times and are successful (*mujarrab*)" "(tried before, experimentally proven").

For believers, engaging in these pious acts and prayers at the prescribed times and in the prescribed ways were a way to obtain aid and intercessions from *Rijāl al-Ghayb* for the inhabitants of this world: in the eyes of some, this diagram was a risk-management tool helping them make an informed decision about whether or not to fight or travel on certain days. For others, engaging in these ominous acts was a way to deal with the fragility of human beings and their inter-dependence on other forces in the universe, and to express deep seated affective states, including anxiety, apprehension, anticipation, but also deep seated wishes and aspirations.

MS Or 477, [*Collection of Sufi Writings and Prayers*], [Turkey?], 1797.
RBML, Gift of Valerie Delacorte in Memory of George T. Delacorte, 2007.

The work on display here, *Tuḥfat al-Mulūk* (The Gift offered to the Kings) is a polemical work involved in legitimization of political authority of the ruler in accordance with the Shiʿite doctrine. Its author, Jaʿfar Kashfī, was a philosopher born in Iran (b.1775–1776/d.1850–1851). It consists of two parts demonstrating the value of reason and its connection to good political ruling, and it can be subsumed under the genre of the "mirror of princes".

The diagram depicts two worlds enclosed in a sphere and clearly demarcated as belonging to two different realms. The top luminous realm with radiant individuals represents knowledge, while ignorance is represented by the upturned individuals surrounded by black concentric circles. The upper limit of the first sphere begins with the metaphysical realm of the intellect (*ʿālam al-aql*), which is the highest realm after the realm of the divine; it is followed by 'the realm of the intellectuals'—*kurat niyām abnāʾ aql*, which is the realm of rational human beings. The bottom semi-sphere shows us the realm of ignorance and diminution, ending with a 'state of demotion deviated from the righteous path'—'*wajh idbārī jahil ʿan l-ḥaq*'.

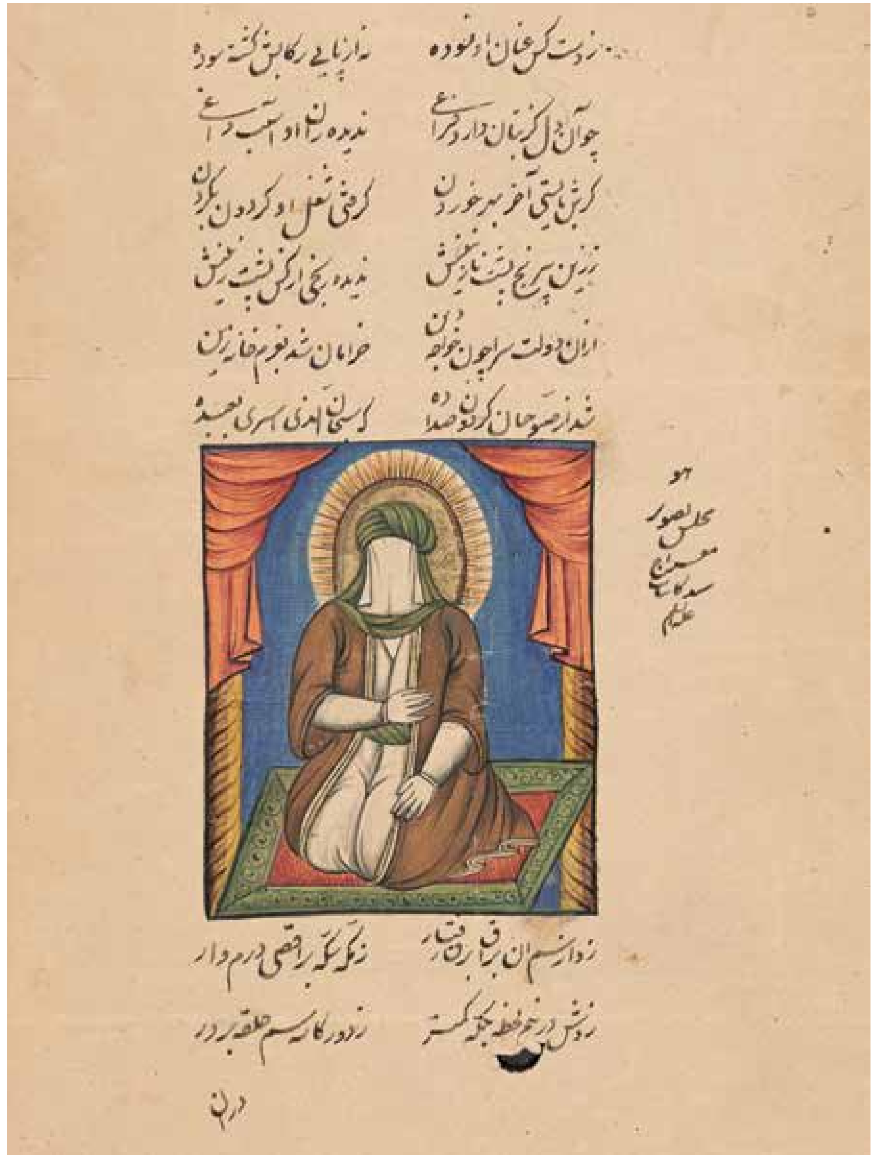
The diagram underlines the value and power of the intellect: it emanates from the heavenly realms down to the 'sons of Adam' who, so long as they rely upon and use the rational power they possess, can remain close to the realm of the transcendental. On the other hand, deviation from the *haqq*, the righteous path, and misuse of their intellectual ability, results in the debasement of their essential nature and takes them away from the transcendental. The diagram shows the righteous as guided by an exalted figure who acts as the source of the intellect, while the ignorant are also guided by those who stroke their negligence. This Platonic depiction (also adopted by the philosopher al-Farabi, reinforces the idea of an Islamic cosmography which is responsive to and influenced by human actions (knowledge and ignorance, good and bad) at the levels of both macrocosm and microcosm.

MS Or 146, Kashfī, Ja'far ibn Abī Isḥāq, (d-1850 or 1851),*Tuḥfat al-mulūk*,
Copy of a treatise; two volumes in one; the first is about intellect, reason, ignorance, and the second about politics, [Iran?], 1818.
RBML, Gift of David Eugene Smith, 1931–1934.

A versified work about the Prophet's night journey (*isrāʾ*) and ascension (*miʿrāj*) to the Seventh Heaven to meet his Creator. *Laylat al-isrāʾ* (the night of the journey) or *laylat al-miʿrāj* (night of ascension) is one of the holiest nights in the Islamic calendar and is celebrated every year on the 27th of the month of Rajab. During this night, the Prophet is said to have been in the *Masjid al-Ḥarām* in Mecca when the archangel Gabriel came to him with a winged stallion (in other stories, a flying carpet, a *rafraf*) and carried him to the *Masjid al-Aqṣā*, the "Farthest Mosque", in Jerusalem, where he performed prayers at the Temple Mount. In the second part of the journey, the *Miʿrāj* ("ladder", ascension), the Prophet toured the seven Heavens and spoke with the prophets who preceded him such as Abraham (Ibrahim), Moses (Mūsā), John the Baptist (Yāḥyā ibn Zakarīyyā), and Jesus (ʿĪsā). Gabriel then left the Prophet alone when they reached *Sidrat al-Muntahā*, the furthest point in Islamic cosmology below the Creator, well beyond a holy tree in the seventh heaven, the sacred lote tree (Ṭūbā), where he had the honor reserved for him alone of standing in the august presence of his Creator. It is said that it was at this time that God prescribed the five daily prayers to all Muslims.

UTS Ms. Tur. 1, Miʿrājīya, 1700s.
Union Theological Seminary UTS, Burke Library.

Displayed here is a leaf from *Jāmī‘*’s (1414–1492) allegorical sufi poem *Yūsuf wa Zulaykhā*, where Zulaykha’s longing for Yūsuf ultimately stands for the soul’s longing for the divine. The transformation of Zulaykha’s uncontrollable passion for Yūsuf into a spiritual journey illustrates the power of sufi love, *muḥabba to seek the divine*. The leaf contains section 7 of the poem, about the Prophet Muḥammad’s *mi‘rāj* with an illustration of the Prophet inserted between verses 23 and 24. The Prophet is depicted as an illuminated figure sitting on a silk carpet (the *Būrāq*) on the night of his journey (*isrā’*) from Mecca to Jerusalem’s Al-*Aqsa Mosque* (The farthest mosque). Ibn Isḥāq (d. c.151/773), in the section on the *isrā’* in his *sīra*, states that al-*Burāq* is “the animal whose every stride carried it as far as its eye could reach [and] on which the prophets before him [Muḥammad] used to ride.”



MS Or 146a, Jāmī‘, 1414-1492, [*Leaf from Yūsuf va Zulaykhā*], [Iran?], 1725.RBML, Gift of David Eugene Smith, 1931-1934

MS Or 20, Taṣrīḥ fī sharḥ Tashrīḥ al-aflāk /(India?, 1800?-1899?, Item is undated. Perhaps produced in India in the 19th century.)

Following the classical Islamic period, an extensive tradition of commentary and glosses emerged throughout the Islamic societies. Commentaries (sharḥ), expansions (mabsūṭ), abridgements (*mukhtaṣar*) and marginalia (*ḥawāshī*) of classical treatises became a common societal phenomenon. At display is a copy of a commentary on Bahā' al-Dīn al-'Āmilī's (d. 1621, Isfahan) treatise on astronomy, Tashrīḥ al-aflāk (Analysis of the heavens). Extensive marginalia including some tipped in note pages and notes at the beginning and end are visible throughout the manuscript. Diagrams are marked by red fore-edge tabs. The pages on display explain the motion of the sun through the horizon and in concomitance with other planets.

G93 .Q3, Qazwīnī, Zakarīyā ibn Muḥammad, approximately 1203–1283, *Zakarija ben Muhammed ben Mahmud el-Cazwini's Kosmographie*, Göttingen, 1848–49.

RBML, From the library of Saʻīd Nafīsī.

The *ʿAjāʾib al-Makhlūqāt* begins with four *muqaddimāt* or prologues. The first provides an exposition of created "marvels" and includes a psychological explanation of their attraction to the human mind; the second describes the two subdivisions of creation, those that can exist independently by their essence, corporeal or spiritual, and those that are only accidents; the third defines the strange and remarkable (*gharāʾib*); and the fourth mentions the subdivisions of existing beings. The work is divided into two maqālāt or discourses, the first on *al-ʿūlwīyāt*, supra-terrestrial objects and phenomena (heavenly bodies, the moon, the sun, the planets, the fixed stars, eclipses) and the second on terrestrial ones (*al-suflīyāt*). The second discourse is almost four times as long as the first; it begins with a description of the four elements, the winds, and phenomena such as rainbows, thunder, and lightning. This is followed by the division of the earth into seven component climes, offering a description of all the known seas and islands, followed by an examination of the three realms of nature: the mineral, the vegetal (trees, plants, fruits, vegetables), and the animal.

Displayed here are lunar eclipse diagrams from a lithographed book entitled *ʿAjāʾib al-makhlūqāt wa gharāʾib al-mawjūdāt* ("Marvels of created things and remarkable features of existent things"), often referred to as the Cosmography of al-Qazwīnī (1203–1283). ❖

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Keeping Time: In Synchrony with the Heavens

"Neither astrologers nor timekeepers
know the long midwinter night
Ask he who is sunk in despair, how many hours
the nights last." (A Turkish proverb)

"The Holy Quran encourages Muslims to seek knowledge throughout their lives, no matter what the source or where it might lead geographically. Islamic civilizations have celebrated and worked towards cross-boundary knowledge sharing. Al-Jazarī, for example, once built an elaborate clock, the Elephant [water] Clock, in order to celebrate the diversity of mankind and the universal nature of Islam. It depicted different Greek, Indian, Phoenician, Chinese and Persian artifacts on the clock as, by that time, the Muslim world had spread from Spain to Central Asia."

Caroline Ellwood,Learning and Teaching about Islam: Essays in Understanding, John Catt Educational Ltd, 2012, p. 31

The new rising Islamic faith presented believers with a number of crucial practical religious injunctions: the need to determine prayer times accurately (five times a day at sunrise, noon, mid-afternoon, sunset and night); the direction of the *qibla* (direction for prayers, facing towards the holy *Kaʿba*), and the lunar calendar and the holy months (*Ramaḍān*, the month of fasting, and *Dhū l-Ḥijjah*, the month of pilgrimage).

As a result of these practical and religious concerns, a new interdisciplinary science called *ʿilm al-mīqāt* (the science of timekeeping) emerged. This science was closely aligned with astronomy, mathematics as well as religious legal theory. With *ʿilm al-mīqāt*, we clearly see what David King called "astronomy in the service of Islam": astronomy helped to answer some practical and religious needs and was sustained and nourished in turn. The center of these time-keeping activities was often the mosque or the observatory. Under Mamlūk rule, the profession of "the timekeeper" (*al-muwaqqit*) was created as an official position which was attached to the mosque for the specific purpose of "correcting" time. Many *muwaqqits* went on to become influential scholars: the most famous example being Ibn al-Shāṭir (1305–1375) who was employed in this capacity at the grand Umayyad mosque in Damascus.

The need for precise timekeeping, among other things, required the development of observatories well equipped with astronomical instruments to observe (*raṣad*) the stars systematically and record their movements accurately. Mass calculation methods were devised and put at the service of providing multiple answers to a question, allowing for both local solutions as well a "universal" (across locations and latitudes), or for devising "perpetual" calendars which allowed calculations and timekeeping across many years, and different systems of keeping calendars (Gregorian, Hijri, etc.). In addition, measuring and recording instruments such as astronomical handbooks or *Zījes*—(containing elaborate tables for solar, lunar, planetary and stellar astronomy) and calendars (*rūznāmah*, *taqwīms*—from the word *qawwama*, to correct, to calculate, measure, [timekeeping]) were compiled and then copied widely and made available. *Zījes*, as well as some calendars recorded a plurality of calendars that allowed users to convert dates, latitudes, longitudes "on the spot", regardless of one's location and across the large swaths of land that the Islamic empire had spread across. Other instruments of measurement and navigation, such as astrolabes,—more expensive than zijes and calendars—were packed with information, often functioning as a small, portable calculators, allowing users to determine one's latitude, the position of the stars, the time of the day, and even one's zodiac with a small swipe of the hand.

The items on display here—astronomical and astrological manuscripts, physical instruments, a geographical treatise, and a prayer manual—help us to appreciate the extent to which science

and its tools permeated every day life within Islamic societies, and supported the aspiration to be "in synchrony with the heavens." (David King) The keen sense that the universe itself was "dynamic", interrelated and composed in harmony, and that humans were only one small part of a vast universe, all undergirded the value of dynamic scientific curiosity and of scientific humility. This in turn worked not only to promote astonishing progress in the sciences, but also to motivate individuals to attempt to attune themselves with the cosmos, both at the micro and macro levels. Within this worldview, "auspicious" times could be held to follow both from the specific alignment of the stars and their influence on us and equally from the human actions that participate in acts of "synchrony" such as prayer (*ṣalāt*, being in *ṣila*, in touch with God and His Creations) and ṣūfi meditation, which aimed at attuning the self in time and space with the universe.

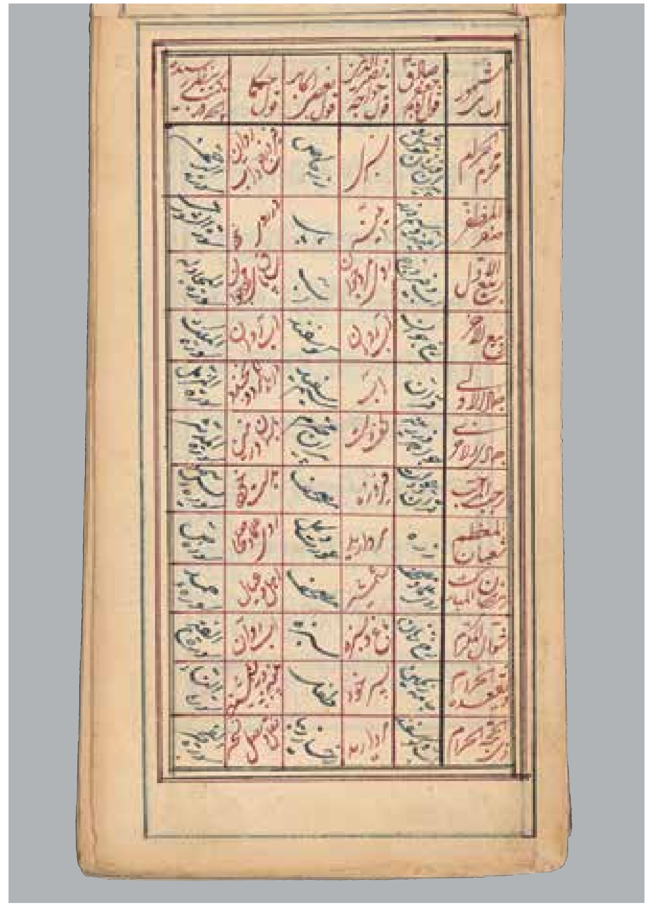
On display here is a geocentric representation of the universe by al-Ṭusī. According to al-Ṭusī, the earth is at the center of the universe and there are six planets that revolve around it, namely Moon, Mercury, Venus, Mars, Jupiter, and Saturn (hence, *sabā*ʿ *sayyara*, seven planets, including Earth). These planets are considered "moving" planets, *kawākib sayyāra*; the rest are deemed as *kawākib thābita*, or stationary stars, because of their fixed positions. According to al-Ṭūsī, every planet has its own sphere or orb (*falak*) around which it orbits and revolves, and encompassing the spheres of the seven planets is the *falak*

MS Or 11, Ṭūsī, Naṣīr al-Dīn Muḥammad ibn Muḥammad, 1201-1274, Dar maʻrifat-i taqvīm mushtamil bar sī faṣl, 1600. RBML, Gift of David Eugene Smith, 1931-1934 *al-aflāk* or the *falak al-muḥīṭ* (surrounding sky). Below the *falak al-muḥīṭ* and above the *falak al-zuḥal* (sky of Saturn) is the *falak al-burūj* or the sky of the twelve constellations. The mathematical computations of the planets' movements, such as the one in al-Tūsī's work, allowed astronomers to compile elaborate calendars, *taqwims*, and determine time within a day, a year, or a cycle regardless of one's location.

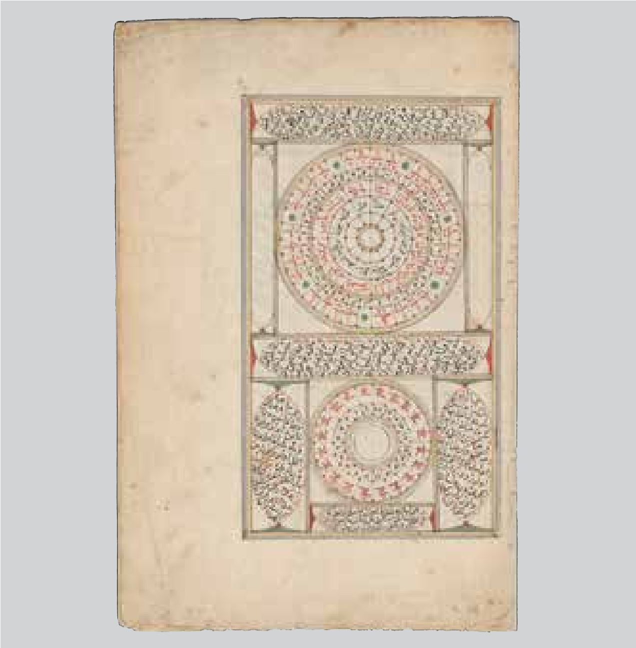
Naṣīr al-Dīn Muḥammad ibn Muḥammad al-Tūsī (1201-1274) was a philosopher, physician, astronomer, and vizier during the Ilkhanid dynasty. Al-Ṭūsī witnessed first-hand the siege of Baghdad, its fall, and the death of the Caliph al-Mustaʿṣim in 1258 (Jūvaynī, III, pp. 290-91). Perhaps one of the most influential mathematicians and astronomers to have ever lived in the Islamic world, al-Ṭūsī made significant contributions to many academic fields including geometry, algebra, arithmetic, medicine, metaphysics, logic, ethics, and theology, and is credited with making trigonometry a new self-standing discipline along with compiling a great number of accurate tables of planetary motion and producing a critique of ptolemaic astronomy that is said to have influenced Copernicus' heliocentrism.

The term "*taqwīm*" refers to three types of interrelated compositions (Tunç Şen, 2016): i) surveys of knowledge displayed in tables, charts, and diagrams; ii) annual astrological predictions and calendric information; and iii) calendars in the modern sense of the word.

A collection (*majmūʿa*) of short prayers for different times of the day, days of week, and parts of the lunar month. The table depicts the months of the lunar calendar together with Quranic chapters, and sayings of of the Ismāʿīlī/Twelver ʾĪmām Jʿafar al-Ṣādiq, Khwāja Naṣr al-Ḍīn. It includes an injunction that the prayers should be recited during specific months of the year. Medieval Muslims strongly believed in the science of lettrism (*ʿilm al-ḥurūf*), where each letter of the alphabet was believed to have a particular influence and effect. *ʿIlm al-ḥurūf* was used to determine auspicious times when particular letters were to be combined or synchronized with specific prayers, and were to be recited at specific times and in specific combinations and orders, in order to bring good fortune and ward off the evil eye.

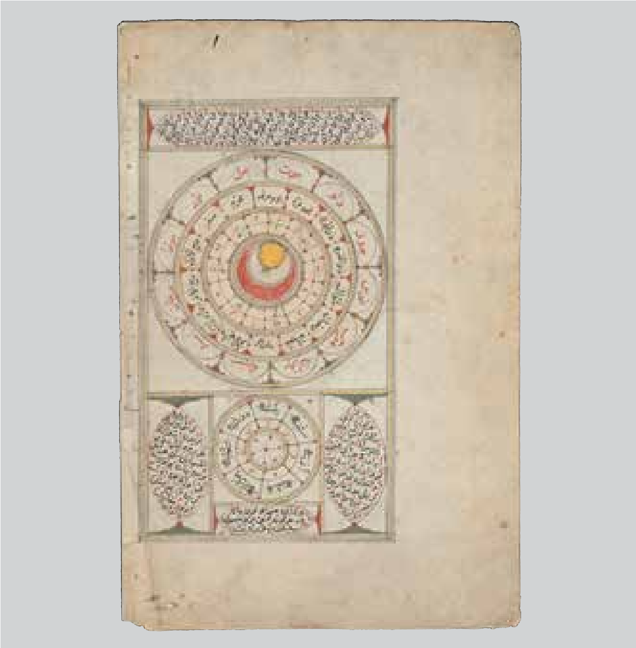


MS Or 142, Several unidentified authors; Muḥsin al-Sharīf al-Ḥusaynī, scribe, active 1849 [Collection of prayers], 1849. RBML, Presumed to be a gift of David Eugene Smith, 1931-1934



MS Or 24, [Calendar for year 1064 AH], [Turkey?], 1653. RBML, Gift of David Eugene Smith, 1931-1934

Turkish calendar, with a lunar table showing the phases of the moon. It includes information on lunar months of the year and astrological signs for finding the best times for prayers intended to cure different illnesses. The diagrams are adorned with beautiful calligraphic script with a variegated blend of ink ranging from black, red, blue and green. The expansive spherical cycles depicted in the diagrams suggest a recurring cycle. Another noteworthy aesthetic feature is the cypress-like trees toward the sides of the portals. This particularly fine manuscript testifies to the resources and efforts invested in the production of such calendars, which in turn are indicative of the great societal interest in these sciences and the usefulness of the timekeeping tools they produced.



MS Or 24, [Calendar for year 1064 AH], Turkish calendar, with a lunar table showing the phases of the moon. 8v, [Turkey?], 1653. RBML, Gift of David Eugene Smith, 1931-1934

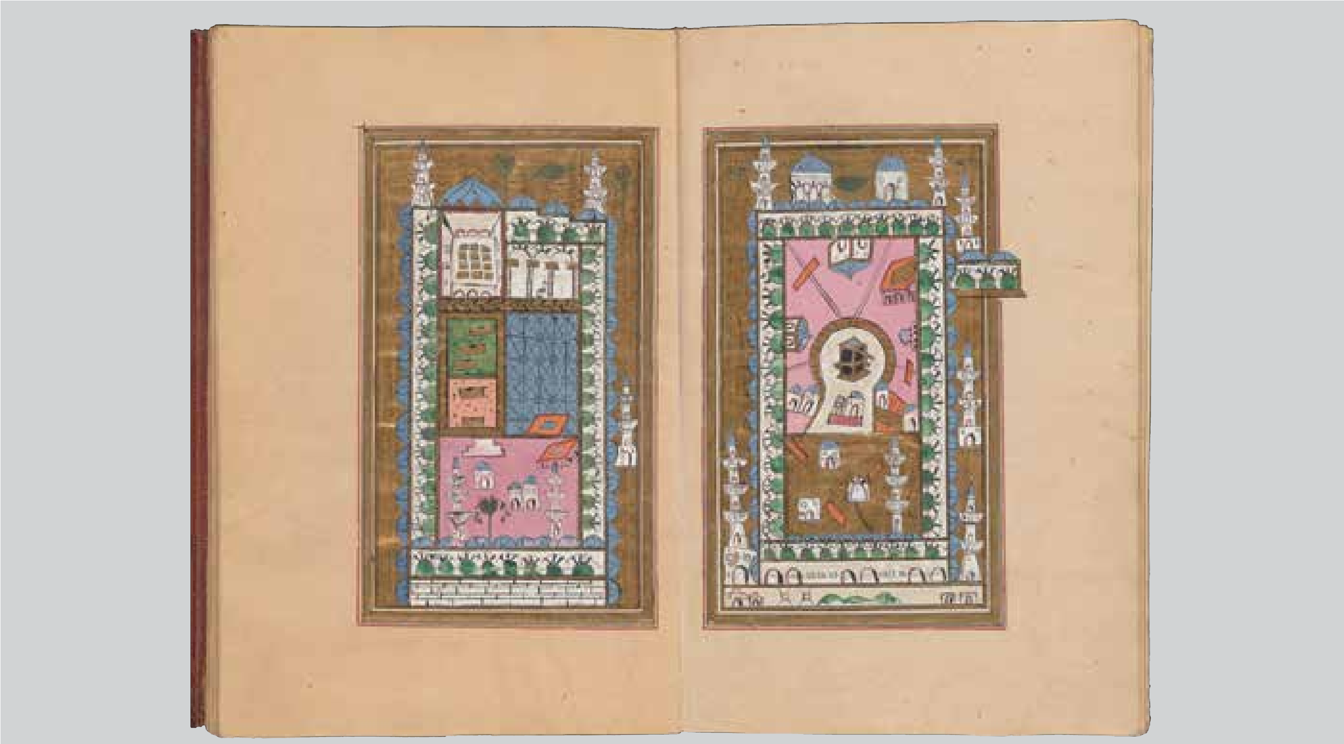
Another page from the same Turkish calendar for the year 1064/1654. The central large circular sphere is framed by beautiful calligraphy in a blend of colorful inks in different hues (blue, red, black). At the center of the sphere is an interactive moveable dial with a pointer which can be turned to point to particular days of the month, and help determine the zodiac influences for those specific days. As the dial moves, the central yellow circle projects the phase of the moon on the desired day.

MS Or 261, Jazūlī, Muḥammad ibn Sulaymān, 1404-1465, [Dalā'il al-khayrāt] [Morocco ?] [between 1800 and 1850?]. RBML, Presumed to be a gift of David Eugene Smith, 1931-1934

Apart from the five daily prayers, Muslims also observe the pious act of bestowing blessings upon the Prophet (ṣalawāt). Sometimes such blessings are offered in a series of repetitions possessing a rhythmic character, the aim being to align with the rhythm of the cosmos and thereby attain proximity to the metaphysical realm.

This copy of the Dalāʾil al-Khayrāt dates from the 19th century and the page on display here reads: "God will create a legendary bird from the blessings (ṣalawāt) upon the Prophet which will have seventy thousand wings, each wing comprising seventy thousand feathers, each feather bearing seventy thousand heads, each head containing seventy thousand tongues, each of which will bless the Prophet in seventy thousand languages and the reward of all will be given to the person who prayed *Ṣalawāt*."

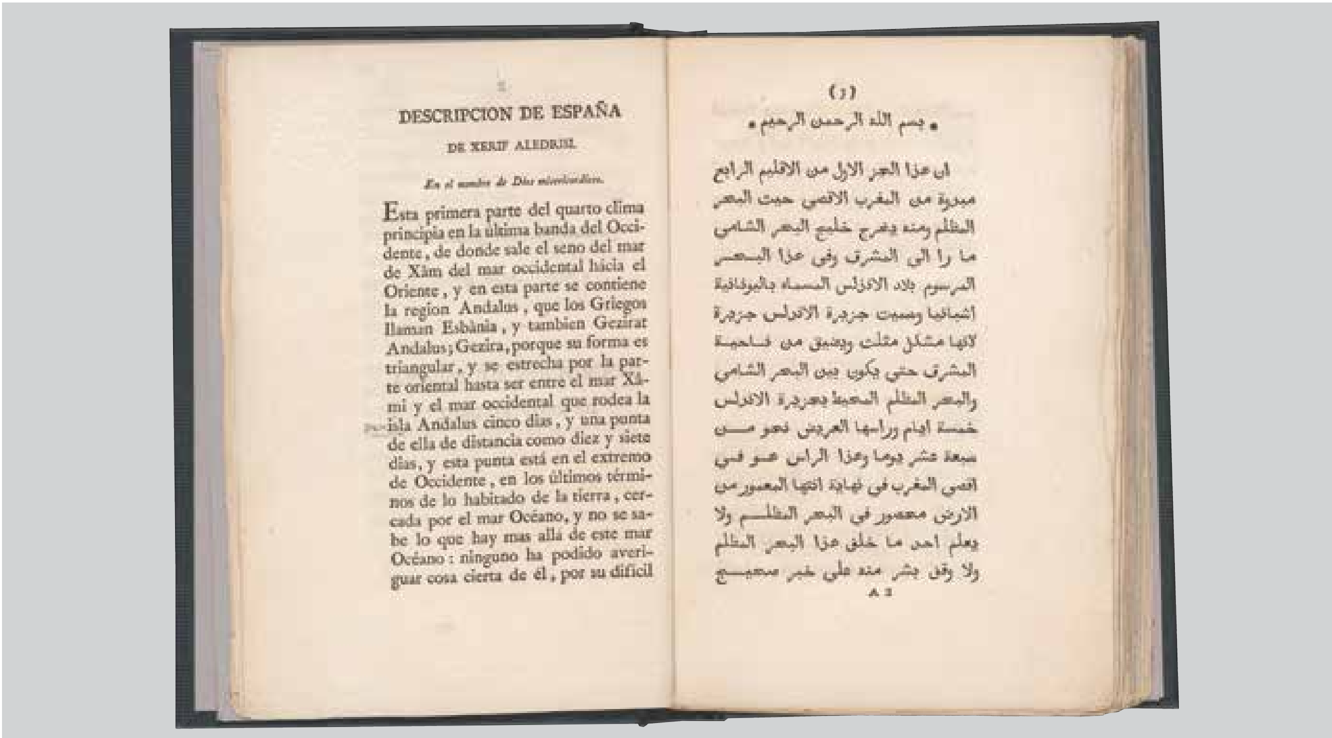
Exemplary here is the compilation of blessings known as *Dalāʾil al-Khayrāt* and composed in the fifteenth century by the Moroccan Ṣūfī saint al-Jazūlī (d. c. 870/1465). A possible source of inspiration for al-Jazūlī may have been the Portuguese invasion of Tangier in 1437, as this work is held to offer solace in the face of hardships. It became immensely popular as a "Book of Hours," especially in North Africa, where, it was said, every household owned a copy.



MS Or 229, Jazūlī, Muḥammad ibn Sulaymān, 1404-1465, Dalāʾil al-khayrāt wa shawāriq al-anwār fī dhikr al-ṣalāh ʻalá al-nabī al-mukhtār, [Turkey?], Copy completed in 1251 AH by Ḥasan Niyāzī Afandī'zādah Muḥammad Amīn Ḥilmī, a student of ʻAlī ʻUlawī, 1835 or 1836. RBML, Gift of David Eugene Smith, 1931-1934

This second example of the very popular *Dalāʾil al-Khayrāt* also dates from the 19th century. Overall, this is a fine example of the way in which it was thought important to "map" sacred spaces as the presence of the visceral images in *Dalāʾil al-Khayrāt* permits believers to experience the close proximity to the Prophet as they engage in recitations and prayers.

The two pages showcased here depict Mecca and Medina, the two holiest cities in Islam. The beauty of the illustrations and the variegated blend of colors meshing with the lustrous golden background and border are outstanding. At the center of the illustration of Mecca stands the Kaʿaba and the houses that surround it. One special feature of this illustration is the depiction of the minarets of Masjid al-Ḥarām, the holiest mosque for Muslims. Also noteworthy is the detailed rendering of five tombs in Medina (three are typical, namely those of the Prophet and the first two caliphs, but here we see those of two other caliphs in the square below).



893.7 Ed7, Idrīsī, approximately 1100-1166, Dhikra al-Andalus tālīf Sharīf al-Idrīs = con traducción y notas de Josef Antonio, Madrid, 1799. RBML

On display here is a rare book entitled *Descripcíon de España* which is one of the first translations of *Dhikr bilād al-Andalūs* by the famous Moroccan geographer Muḥammad ibn Muḥammad al-Idrīsī (circa 1100–66). The translation in Spanish was carried out by Josef Antonio Conde and was published at the Royal Printing Press in Madrid in 1799. Al-Idrīsī's excursions are testimony to Muslim geographers' great interest in travel, which was fueled by the Quranic instruction to contemplate God's creation (29:20) and marvel at the secrets of the universe far and wide.

Al-Idrīsī was of noble Andalusian lineage and studied in Cordoba and traveled extensively in the Mediterranean and Atlantic coastal regions. He became a famous geographer and cartographer, and his discoveries and maps were a phenomenal contribution to the field of geography during that time. One of his most famed works is the map entitled *Nuzhat al-mushtāq fī ikhtirāq al-āfāq* (The Excursions of the one who yearns to penetrate the horizons), known as *Tabula Rogeriana*, which was commissioned for King Roger II of Sicily. For almost three centuries, this work remained one of the most accurate and influential maps.

Instrument, No. 68. Perpetual calendar. Engraved arabesques, Undated. RBML Smith, Arabo-Persian, Indic instruments

This *Rūznāme* (calendar) contains a set of tables giving the first days of the months in both the Islamic and Rūmī calendars, the date on which the sun enters each sign of the zodiac, as well as the dates of the eclipses of the sun and the moon. Perpetual calendars are also known as "*taqwīm-i dāʾimī*" or "*taqwīm-i devr-i dāʾim*" (calendar of perpetual motion). This type of ruznāme required extensive data collection, as well as the application of "mass calculations" and were "permanently" valid across locations and multiple years: they relied on universal algorithmic calculations that would allow users to infer the right dates, times of the day, regardless of location or of specific year. There is no evidence that such calendars were produced in pre-Ottoman times, and they may therefore be regarded as a type unique to Ottoman Turkey.

Horizontal Plate Sundial, Jaipur, [19th century], Smith 27-218. RBML Smith, Arabo-Persian, Indic instruments

The instrument on display here is a horizontal plate dial which is the most common type of sundial and has a foldable gnomon (arm) which makes it travel friendly. Other large dials of this kind, typically made for outdoor use in a fixed position, were also very common. This portable dial would have to be oriented correctly so that the shadow cast by the gnomon on the engraved hour lines on the outer ring depict the time correctly.

According to the Syrian astronomer al-Battānī, sundials (*sāʿat aftābī, sāʿat shamsī*) were in use across the Islamic empire until the 4th/10th centuries and were later replaced by water and mechanical clocks. Gnomonics, the science of constructing sundials, was particularly important to Muslims because it helped them to determine the correct times for the five daily prayers. The earliest known portable sundials of the Islamic period are both dated 554/1159, one in the collection of the Aḥmadīya Madrasa in Aleppo, the other, made for the Zangid ruler of Syria Nūr-al-Dīn Maḥmūd (d. 569/1174),which is housed in the Bibliothèque Nationale, Paris.

Astrolabe-like instrument, Lahore, attributable to Lalah Bulhomal, [ca. 1839-1851], Smith Instruments 27-199. Gift of David Eugene Smith

As described by S. R. Sarma, this astrolabe-like instrument appears to have been invented by the prolific 19th century Lahore instrument maker Bulhomal. Produced primarily between 1839-1851 for the court of the Raja of Kapurthala, Bulhomal's astronomical instruments (nearly 28 instruments) are the last true stylistic representation of Arabic, Indo-Persian and Sanskrit traditions. Written on the front of the instrument is "diagram for victory," suggesting a military use, possibly in the ongoing conflicts between the Sikh kingdom and the East India Company. On this astrolabe, Bulhomal amalgamates the Arabic alphabet-numerical system of Abjad with the Devanagari numerals to produce an Indo-Persian tradition. The design of the kursi or throne of the astrolabe acts as a signature of Bulhomal- this trifoliate shape of the finial was a defining feature of the Allahdad family. The 12 divisions of the elliptical ring hold the names of the zodiac signs and a series of clockwise numerals from 1 to 60.

Astrolabe & Quadrant, Hindu, [18th century], Smith Instruments 27-253. Gift of David Eugene Smith

Here, we see a Rub'ul Mujayyab, or cynical quadrant, from 18th century Hindustan- a medieval Arabic instrument that was used to measure time, directions, celestial angles, and object positions. The combined astrolabe and quadrant is a graph-paper like grid which is divided into 90 equal degrees from both ends of its arc. A khait, or plumb line, was attached to the apex where the right angle forms to measure celestial altitudes. The tube-like instrument at the top repurposes as a telescope attachment to the quadrant.

In the early 18th century, several large observatories and instruments were built in order to rival the Samarkand observatory and improve earlier Hindu computations from the Siddhantas and Islamic observations from Zij-i-Sultani. Instruments like these, therefore, were influenced by Islamic astronomy and astrology, while computational techniques were taken from Hindu astronomy.

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Teaching, Pedagogy and Adab

The Requisites of Knowledge:
A quick mind, zeal, poverty, foreign land,
A Professor's inspiration, and of life, a long span.

ذكاء وحرص وافتقار وغربـة
وتلقـين أستاذ وطول زمان

Juwaini of Nishapur (d.1085)
(Dhail, (Z), folio 13a)

A humble mind, zeal for learning, a quiet life,
Silent investigation, poverty, a foreign land.
Mens humilis, studium quaerendi, vita quieta,
Scrutinium tacitum, paupertas, terra aliena.

Bernard of Chartes, (d.c. 1130), (*Policraticus, VII, 13*)
(Quoted in George Makdisi, The Rise of Colleges, Quoted on p.1)

A robust network of schools and libraries, and study groups (*madrasas*, *ḥalaqās* or study circles, as well as *majālis*, symposia) were widely accessible to all seekers of knowledge in the Islamic worlds, and these educational institutions, which were state sponsored or supported through personal or family waqfs (endowments), undergirded a stupendously dynamic network of knowledge transmission. Such institutions took different forms: the *jāmiʿ*, the mosque, was perhaps the primary among them, undergirding the symbiotic relation between the new faith, the importance of education and the rising scientific outlook. The mosque had *ḥalaqās*, study circles, as well as *majālis*, (symposia or specialized discussion sessions which focused on specific subjects), and sometimes *ḥalaqās* provided appointments to teaching posts which amounted to professorial chairs; *zāwiyas* and *khānaqas* (corners of the mosque where spiritual and ṣūfī teachings were offered) also existed. Also attached to mosques were *madrasas*, the many arms of the Islamic College which originally focused on the study of *sharīʿa* or Islamic law with an extensive curriculum that included not only religious sciences but also literary ones, including grammar, language, rhetoric and logic).

The seeking, sharing, and transmission of knowledge, *ṭalab al-ʿilm*, was considered a pious endeavor; conversely, hoarding knowledge was as sure a sign of a miserly soul as the hoarding of material wealth. At the center of this dynamism was the practice and art of teaching. Teachers were highly venerated: Aristotle and al-Fārābī were identified as the first and second teachers respectively, and often referred to with reverence. The teacher/student relationship was considered akin to a moral, spiritual or even familial (mentoring) relationship that involved far more than the direct imparting of facts or skills: extensive travel in search of a teacher, long apprenticeships, often including living with the teacher for an extensive period of time, and a stress on the crucial importance of emulation, inspiration, and the formation of scholarly character and habits were all key elements here. The scribal practices that grew out of these relationships are in evidence with the immense body of surviving manuscripts from the Islamic world, and in the items on display in this window.

These items cover a wide range of subjects (language, rhetoric, grammar, belles lettres, astronomy) and periods, but they all bear testimony, through the various marks of the sophisticated educational system contained in their pages (annotations, marginalia, *ijāzāts*, abridgments of a teacher's work and then expansions, dedication of manuscripts to *awqafs*, and colophons, etc.), to the high value assigned to knowledge in Islamic cultures throughout the centuries.

The ubiquity of surviving grammar, rhetoric, and poetry works also demonstrates the importance of eloquence and rhetoric for all scholars, regardless of their field. *Adab* covered a wide array of

topics and literary styles, from poetry to prose, but was typically unified through a shared interest in etiquette and ethics as much as rhetoric and the literary imaginary.

Also on display here are more practical compendiums and manuals, and even a small portable "library", a *majmūʿa* (compilation) of multiple works that could support a specific curriculum, or simply reflect the taste and references of a learned individual, in ways not so dissimilar of how our modern kindle library. A writing tablet illustrating the intimacy of the teacher/student relationship, away from generalized lessons delivered through a blackboard for an entire class are also on display. A beautiful abcd work with a touching prayer is also on display: "May my learning be easy; may it be successful."

Perhaps the most famous Persian poet, Omar Khayyam, d.1048-1131, was also a celebrated polymath, a prominent scientist, astronomer and mathematician. He was among a group of scholars who established the new solar Jalālī calendar, produced manuscripts on Euclid's elements, algebra, the division of the quadrant in a circle, cubic equations, and the extraction of the nth root of numbers, among other mathematical achievements. The second quatrain on folio 1 addresses the theme of ostentatious piety. Khayyām sang humorously: *"If wine you drink not; don't reprimand the drunk."* Khayyam's Rubāʿīyāt were translated by many Orientalists, most famously by Edward Fitzgerald (1809-83)

MS Or 344, Omar Khayyam, 1048-1131, *Rubāʿīyāt-i ʿUmar Khayyam*, Collection of quatrains, Iṣfahān, 1688. Illuminated headpiece in gold, blue, red, and green with border-rules in blue and gold, copied by Muḥammad ʿAbd al-Subḥān in Iṣfahān, Iran, and purchased in 1907 from a Persian manuscript dealer in Lahore, India. RBML, Gift of David Eugene Smith, 1931-1934 and produced a real “Omar craze” in Europe and North America in the 19th and 20th c. Khayyam’s name and verses became associated with (or included in) works of music, paintings, drama, films, poetry and novels, and even in advertisements for countless products, e.g., tobacco, chocolate, perfume, soap, and postcards. (His name also made it into horticulture when a species of a damask rose believed to have grown on Khayyām’s tomb for a thousand years was allegedly brought back to England by Fitzgerald and acquired the name “*ʻUmar Khayyām*.”) His poems, often marked by cutting wit, center around the love of the divine; of beauty and wine as Ṣūfī symbols of love; the limitations of human knowledge; and the ephemerality of life.

Al-Kāfiyah (“the Sufficient”) is a work on grammar, written by the Mālikī jurist and grammarian, Ibn al-Ḥājib (b.Esna, Egypt, 1175- d. Alexandria, 1249), to instruct his immediate circle of students on the rules of *al-naḥw* (Arabic grammar). Highly valued for its clarity, the text went on to become a foundational one for the sciences of grammar and generate numerous commentaries and other exegetical works throughout the centuries, resulting in thousands of surviving manuscript copies around the world, including the present manuscript copy. *Al-Kāfiyah* is still taught today, not only at Islamic colleges, but at institutions throughout various parts of the world that provide instruction in Arabic.

The displayed opening pages *1 verso* and *2 recto*, lay down some basic definitions of grammar, starting by defining the noun and then explaining basic categories of names and structures of sentences. Notes can be seen in the margins, but also inter-linearly, sometimes running in different directions (right to left, upward diagonal, downward diagonal), indicating that this was a well-used student copy.

In the Islamic world, al-*naḥw* was considered a major branch of

MS Or 448, Ibn al-Ḥājib, ʻUthmān ibn ʻUmar, [al-Kāfiyah], 1581. RBML learning and indeed was given foundational status in regard to the religious sciences since it aided in *tafṣir*, accurate interpretation of the Quran and the Ḥadith.. Grammar also was thought to pertain closely to the rules of logic and rhetoric, as well as to eloquence and *belles lettres* (pre-Islamic poetry and sayings). And in general it proved fundamental in establishing the preeminence of the Arabic language across vast swathes of land among non-native speakers of Arabic and new converts to the faith who needed a solid grasp of grammar in order to understand the Quran.

MS Or 278, [*al-Abjad*], [Turkey?], 1845. RBML, Gift of George Arthur Plimpton, 1936

In addition to copying complex philosophical and literary manuscripts, it was not uncommon for scribes to produce manuscripts with basic renditions of the Arabic alphabet, works also known as *abjads* (from alif, bā, jīm, and dāl, the first letters in the Arabic alphabet) in order to teach the Arabic language to children and non-native speakers. This delicately decorated *abjad* was produced in Turkey in 1845, (dated 1261) AH and was copied by ʻAlī al-ʻAlawī, "a student of al-Ḥājj Muṣṭafā, Khawājah-yi Mashq-i Sarāy-i Humāyūn (f. 18r). The opening page has a *duʿāʾ*, supplication, that reads: "God, may my learning be easy, not difficult: may it be completed well."

The Arabic language contains 28 letters, all representing consonants, and is written from right to left. Vowels are added in the form of markings either above or under each letter. Vowels at the end of a word indicate its grammatical function within the sentence. Letters are written differently at the beginning, middle or end of the word, depending on the letter's position in the sentence, and whether it is isolated or connected. Thus, students of Arabic must reckon with learning at least 84 forms of different letters before being able to read!

MS Or 516, *Wooden writing tablet for teaching grammar and religion*, [Tangier], [between 1875-1906?]. RBML, Presumed to be a gift of David Eugene Smith, 1931-1934

This trapezoid wooden writing tablet for teaching grammar, writing, religion and mathematics is undated but was probably produced between 1875-1906 in Tangier. The tablet has no handle, just a hole drilled through the upper center, where it probably was hung on the wall along other writing tablets at the end of the school day. The recto has water, scratch marks, and a few words in Arabic, including the name "Abī Yasʿad ibn Aḥmad" and a faint English description of the item are visible. The back of the tablet displays a geometric drawing, akin to Euclid's triangles, probably demonstrating one of Euclid's basic congruence theorems. The board is accompanied with a note in ink which reads: "Tablet used in the schools of Tangier, Tangier, June 1906." The name "Buachend bin H'ameda" is also on the note.

The longstanding use of the writing board as a learning tool (which extended into the early 20th c. in many regions) accorded well with the intimate teacher/student relationship that distinguished the Islamic education system. (Compare the use of communal blackboards with that of small individualized writing pads, and the differential impact on styles of education and pedagogy).

MS Or 300, *Sharḥ Hidāyat al-ḥikmah. Risālah fī ʻilm al-hay'ah*, Composite manuscript of works (*majmūʻa*) related to al-Mufaḍḍal al-Abharī, born probably in Mosul, (Iraq), died in Shabustar, (Iran), possibly 1265, 1495. RBML, Gift of David Eugene Smith, 1931-1934

Compilations, *majmūʻas* such as this one were very popular, and served as a "portable small library" or a curriculum [related textbook, and may reflect a specific curriculum that a student was following, or the taste of the manuscript owner, who may have chosen to bind these works together, for his or her own edification. Extensive marginalia can be seen on the displayed folio (37v-r) suggesting a well-used work.

This is a neatly written copy of some of Maqāmāt al-Ḥarīrī (1054-1122), a compilation of short stories, known as *maqāma* ("sittings" or "sessions"). Each *maqāma* bears the name of the city where the story takes place and depicts wild and humorous adventures of its roguish wandering hero, Abū Zayd al-Sarūjī-the witty, Hilālī, as told by a narrator, al-Ḥarith, a merchant who travels across the lands. The stories are told in poetry and in prose (saj'), and employ unusual meanings of words and elaborate grammatical constructions that help to showcase the skill of the writer, as well as the richness, complexity and beauty of the Arabic language. Since these were stories to be read aloud or recited by a narrator "live" (sometimes with the use of props for the purpose of entertainment), they also rely for their appreciation on the audience's mastery of the language and its complex rules. The copy displayed here is unusual in regard to both its very late date and its place of origin—it was copied in a small village in Mount Lebanon (most surviving copies come from further inland), and because it took the copyist only ten days to complete it! We can assume that the copyist had a stellar mastery of the language and that he enjoyed himself as he copied these tales

MS X893.7 H22, Ḥarīrī, 1054-1122, *al-Maqāmāt*, Dayr al-Qamar (Lebanon), 1820. RBML, Purchased through the Alexander I. Cotheal fund in 1896

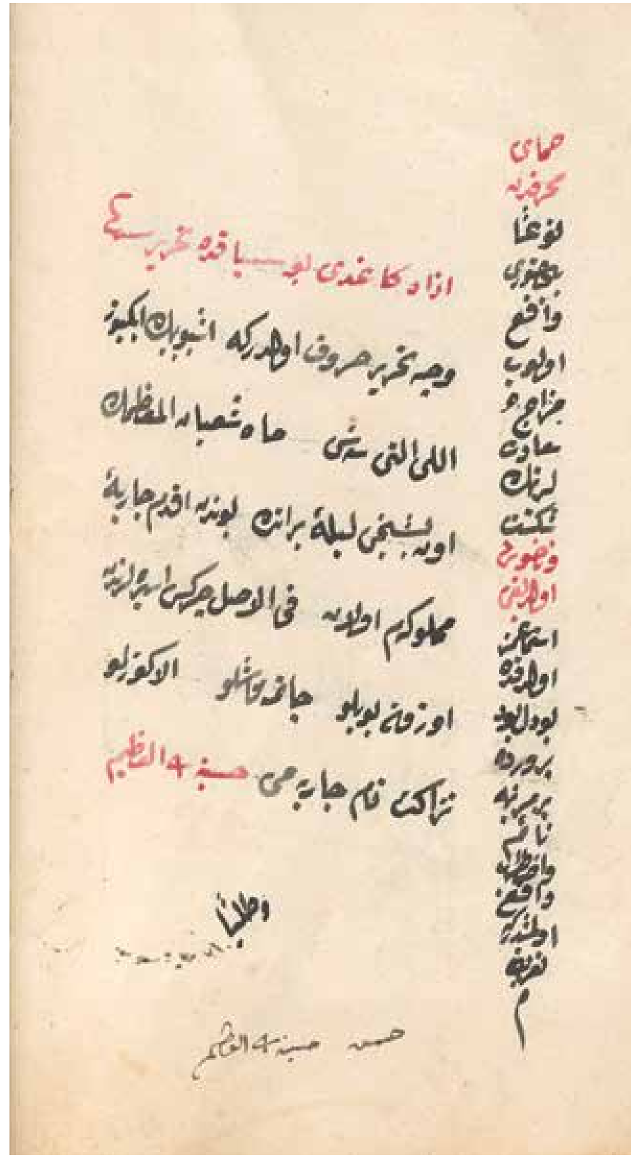
This is a commentary on *Alfīyat Ibn Mālik*, a foundational 13th c. poetic work with one thousand lines of verse whose subject is *nahw* (grammar). The commentary is by ʻAbd Allāh ibn Yūsuf Ibn Hishām (1309-1360), and is a *matn*, i.e., a small book which typically contains an abbreviation or summary of a larger work. It is not atypical to see such foundational works transformed into a *matn* and then expanded on and turned into a *sharḥ* (i.e., an expansion), then summarized again into another *matn*. (For an example of a *sharḥ* work on the same grammar work, Alfīyāt ibn Mālik, please see ms. X893.7 lb 62 displayed in this window.) This kind of chain of collaborative authorial efforts marks a tradition that evidences a pre-modern perspective on the concept of authorship. The inclusion of extensive *marginalias* here also can be understood to expand the notion of authorship of this manuscript even further. We thus have here a nice example of the textual multivocality and shared ownership/authority over a scholarly work characteristic of Islamic science traditions.

MS X893.7 Ib64, Ibn Hishām, ʻAbd Allāh ibn Yūsuf, 1309-1360, *Kitāb Matn al-tawḍīḥ*, 1700-1800?, Copy of a commentary on Ibn Mālik's Alfīyah. Gift of Alexander I. Cotheal (bookplate inside front cover) one of the earliest manuscripts to enter the Columbia University RBML collections.

The work on display bears witness to the importance of epistolary skills and cultures, as well as the effectiveness and power of rhetoric and the pen in Islamic cultures. The *kātib*, secretary, occupied a unique place in the administrative hierarchy and was privileged as a counselor to the ruler and an advisor to ordinary people seeking to navigate the complex administrative systems of medieval Islamic societies.

The work on display begins with an Arabic-Ottoman glossary of terms used in writing official and unofficial letters (f. 1v-3r), and is followed by instruction on the writing of letters of different types, followed by a short lesson on basic arithmetic (f. 34v-35r). Samples of letters include: “from supervisees to supervisors” (f. 10v-14r); “letters home” (f. 14v-17r); “from a child to his grandfather” (f. 17v-19v); “from a father to a son” (f. 20r-22r), etc.

On view here is a sample letter of emancipation, addressed to a slave as a model of what a *mukātabah* (the practice of seeking emancipation through writing letters and petitioning the slave owner to free the slave) could look like. *Mukātabah* is a formal contractual process which involves a voluntary agreement between the slave and the master which cannot be imposed on any party. Depending on the terms of the contract, the slave would pay for his freedom in cash, in goods, or in services. Such a slave was called *mukātab*, or colloquially *kitābetli*, and his was a state of semi-manumission which was immediately recognized upon the signing of the contract, leading to manumission on the fulfillment of the contractual terms. ❖



Ms Or 32, *Treatise on composing letters*, On writing (inshā’),[Turkey?], [between 1775 and 1825?]. RBML, Gift of David Eugene Smith, 1931-1934

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James Pickett, *The Polymaths of Islam: Power and Networks of Knowledge in Central Asia* (Ithaca: Cornell University Press, 2020)

Euclid

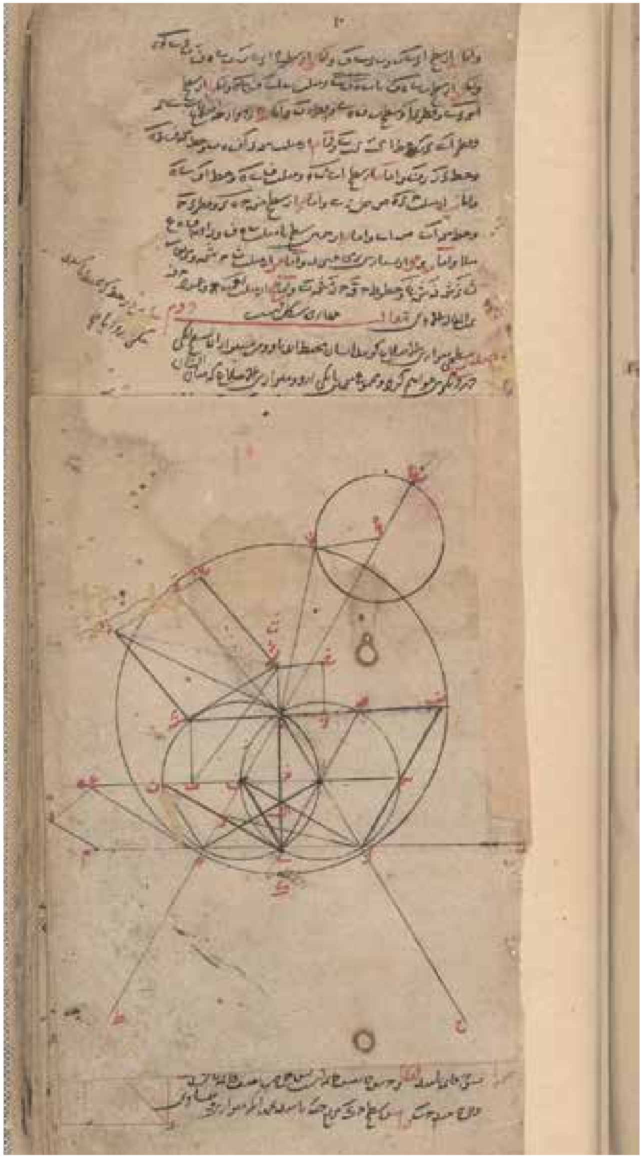
Euclid's *Elements of Geometry* was the standard geometry textbook across Eurasia and Northern Africa for over two thousand years, from its date of composition (roughly 300 BC) in Ptolemaic Egypt until the nineteenth century. Despite its authorship being attributed to Euclid of Alexandria (fl. 300 BC), scholars now believe that this work is a compilation and synthesis of earlier and less formalized mathematical traditions. The *Elements* is written in "axiomatic style", i.e., geometric demonstrations proceeding from a set of definitions, which became the gold standard for mathematical proof in general, and by extension, came to symbolize and embody notions of Western "rationality", and its claims to "universality".

While the Western imprints on display in this window were collected in the service of documenting and demonstrating this vision of a foundational 'Western Euclidian rationality', the Arabic and Persian manuscripts on display here tell another story. If modern ideals of proof and geometric style and clarity are often traced back to Euclid's *Elements*, then this history must in turn be traced through the Arabic tradition. Euclid was lost to Europe until Adelard of Bath (1080-1152 CE) translated an Arabic copy of the Elements into Latin in the twelfth century. Only the Islamicate world has a continuous, unfragmented textual tradition of geometry (*al-handasah*). This tradition is far from monolithic and cannot be neatly abstracted away from its context, language, culture, or the particular concerns of different mathematical communities and scholars within it; it is a *living and lived* discursive tradition rather than one whose authority comes from its textual stability, dogmatic rationalism, or rigid reverence.

Euclid's *Elements* in particular holds a special place in the history of knowledge production and transmission in the Islamicate world. The *Elements* was one of the first books to be translated through the so-called 'Greco-Arabic Translation Movement' in the eighth-tenth centuries, a period of heightened translation and transmission of Greek learning to the Islamicate world. While Euclid's *Elements* may have been a Greek text when it was received, its translation was made for a new audience and it quickly lost its cultural connection to Greek civilization. This work *became* an Arabic text in language and culture and remained essential to the canon of Islamic education even during periods of hellenophobia which sought to purge scholarship of 'foreign' influences.

Until the twelfth century, there were two main Arabic translation traditions of Euclid's *Elements*—or the *Uṣūl al-handasah*. The first translation was produced by al-Ḥajjāj ibn Yūsuf Ibn Maṭar (fl. between 786 and 833) at the Abbasid court under Caliph al-Manṣūr in Baghdad and the second was Thābit Ibn Qurra's revision of Isḥāq ibn Ḥunayn's (d. 910/911) new translation composed in the mid-ninth century. Many commentaries (*sharḥ, ḥāshīyah*), revisions (*taḥrīr*), epitomes, summaries, and expansions were made and circulated for each of these translations until the mathematician and astronomer Naṣīr al-Dīn al-Ṭūsī produced his *Taḥrīr uṣūl al-handasah lī-Uqlīdīs*, which then became the new standard text on which to build from the thirteenth century onwards. Al-Ṭūsī's student, Quṭb al-Shīrāzī (661-710/1236-1311) produced the first Persian translation, also based upon al-Ṭūsī's edition. Translations in Arabic and Persian were made and circulated in madrasas and courts across the Islamicate world (in the Abbasid, Mughal, Safavid, Timurid, Ilkhanid, and Ottoman empires), sometimes made cheaply for students and intended for regular use, sometimes made lavishly as status symbols and gifts.

The polyvocality of the texts on display here (as seen in their multiple authors and scribes, marginalia, commentaries and super-commentaries accumulated over generations of teachers and students) challenges reductive notions of the unilinear "progress" in and universality of the truths of mathematics. These manuscripts show the varied layers of culture and traditions of Euclidean mathematics evidenced by commentaries and translations that talk



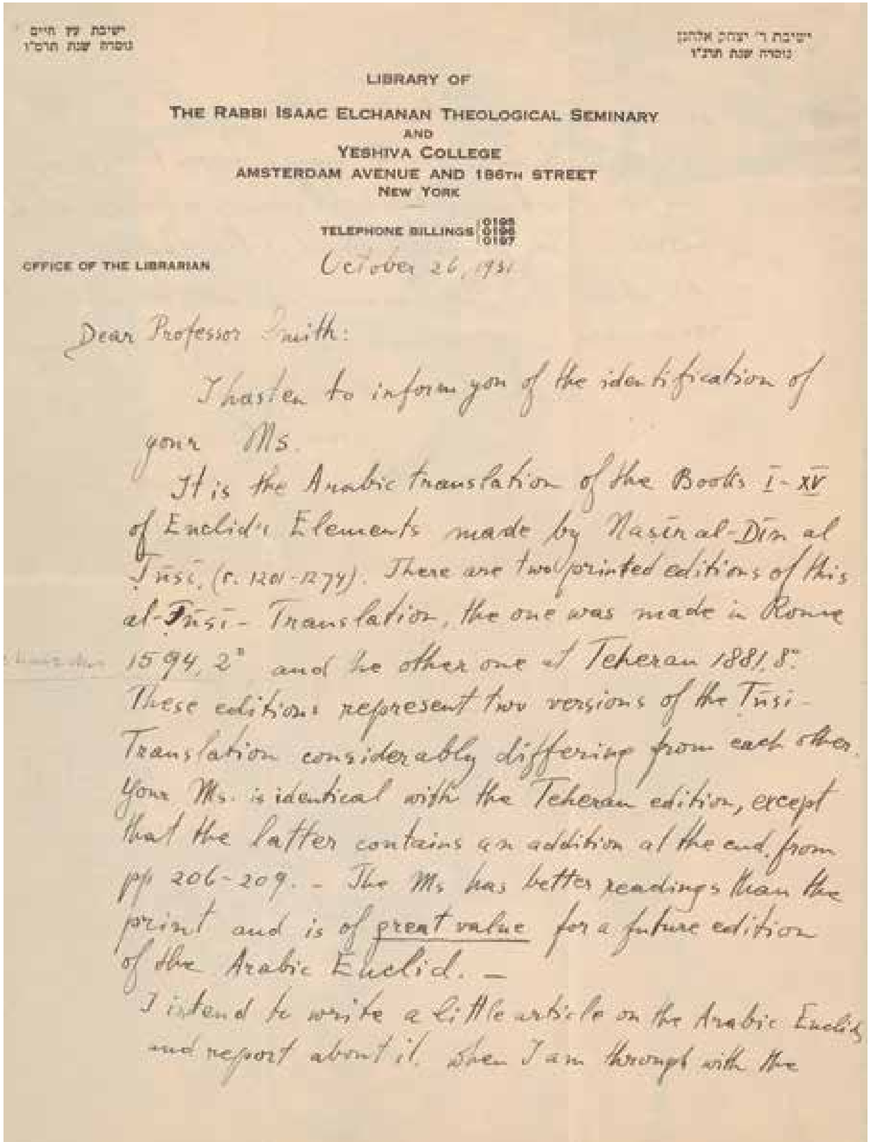
to, at, by, over, and across each other. Editions of Euclid (or *Uqlīdus*) often radically changed the text, got rid of the parallel postulate as dubious, omitted other propositions because they were redundant or proofs rewritten to be clearer to the reader. We see that these texts do not just tell a story of abstract axioms and Platonic forms, but of mathematical pedagogy, both stable and dynamic practices across vast swaths of time and geography, and of vibrant communities of mathematical practitioners, students, teachers, and patrons.

This is a copy of the first translation of Euclid's *Elements* into Persian. The first translation was made in 1282 by Maḥmūd ibn Mas'ūd Quṭb al-Shīrāzī (1236–1311), a Persian polymath and student of the astronomer Naṣīr al-Dīn al-Ṭūsī. The Persian translation is based on al-Ṭūsī's own Arabic *Kitāb taḥrīr al-uṣūl li-Uqlidus* and the addition of books (*maqālah*) 14 and 15 by Asqilānus [Hypsicles]. Shown here is a composite geometric construction that superimposes all of the geometric constructions of the text into one diagram. The copyist has inserted it, likely because he forgot to leave room for it within the pages of the manuscript. Instructions for how to locate each individual diagram within the whole is given underneath and on the previous page.

MS Or 282, Quṭb al-Shīrāzī, Maḥmūd ibn Mas'ūd, 1236 or 1237-1310 or 1311, *Tarjumah-i kitāb-i Taḥrīr-i Uqlīdus dar uṣūl-i handasah va ḥisāb*, The "Persian Euclid", 1378. RBML, Gift of George Arthur Plimpton, 1936.

MS Or 30 FOLIO/FLAT, Euclid, *Uṣūl al-handasah wa-al-ḥisāb* Uqlīdis/translated by Muḥammad ibn Muḥammad Naṣīr al-Dīn al-Ṭūsī, [Iran?], 751 A.H/ 1348 CE.
RBML, Gift of David Eugene Smith, 1931-1934

This is a copy of the Persian polymath Naṣīr al-Dīn al-Ṭūsī's (1201-1274) Arabic translation and 'revision' of Euclid's *Uṣūl al-handasah* through Book XV. In al-Ṭūsī's version, which became the standard version in most parts of the Islamic world, there are many original additions including a proof of the parallel postulate by contradiction and the inclusion of many additional cases for the pythagorean theorem (book 1 proposition 47). This copy includes red and black geometric drawings made by the copyist and also marginal diagrams most likely made by later readers. It also includes extensive commentaries in the form of marginalia (ḥāshīyahs) and interlinear text. On display you can see several instances of super-commentaries (commentaries on commentaries) facing different directions, in multiple scribal hands.



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ישיבת ר' יצחק אלחנן
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October 26, 1931

Dear Professor Smith:

I hasten to inform you of the identification of your Ms.

It is the Arabic translation of the Books I-XV of Euclid's Elements made by Nasir al-Din al Tusi (c. 1201-1274). There are two printed editions of this al-Tusi-Translation, the one was made in Rome 1594, 2° and the other one at Teheran 1881, 8°. These editions represent two versions of the Tusi-Translation considerably differing from each other. Your Ms. is identical with the Teheran edition, except that the latter contains an addition at the end, from pp 206-209. – The Ms has better readings than the print and is of great value for a future edition of the Arabic Euclid. –

I intend to write a little article on the Arabic Euclid and report about it when I am through with the

This is a letter (1931) to mathematician and historian of mathematics David Eugene Smith (1860-1944), the collector of MS Or 30 and the majority of the mathematical manuscripts in this collection. It is from Solomon Gandz (1883-1954), an Austrian historian of mathematics and science, then a librarian and professor of Arabic and Medieval Hebrew at the Rabbi Isaac Elchanan Theological Seminary in New York (part of Yeshiva University). At the time, Gandz was working on publishing the first complete version of the *Mishnat ha-Middot* (*Treatise of Measures*, 1932) the earliest known treatise on geometry written in Hebrew (150 CE) which Gandz claimed represented an important link between ancient Greek and Islamic mathematics. Gandz writes that MS Or 30 is "of great value for a future edition of the Arabic Euclid" and that he intended "to write a little article on the Arabic Euclid." However, as MS Or 30 and the rest of the editions on display in this window show, there is no such thing as "the Arabic Euclid." European and American scholars, with different intentions and levels of competency, had been *looking for an essentialized text and not a dynamic tradition*.

MS Or 30 FOLIO/FLAT, Insert Recto in Euclid, *Uṣūl al-handasah wa-al-ḥisāb*, Uqlīdis/translated by Muḥammad ibn Muḥammad Naṣīr al-Dīn al-Ṭūsī, [Iran?], 1348. RBML, Gift of David Eugene Smith, 1931-1934

MS Or 43, Qāḍī'zādah, Mūsá ibn Muḥammad, approximately 1436, [*Sharḥ ashkāl al-ta'sīs*], [India?], [between 1685 and 1700?]. RBML, Gift of David Eugene Smith, 1931-1934

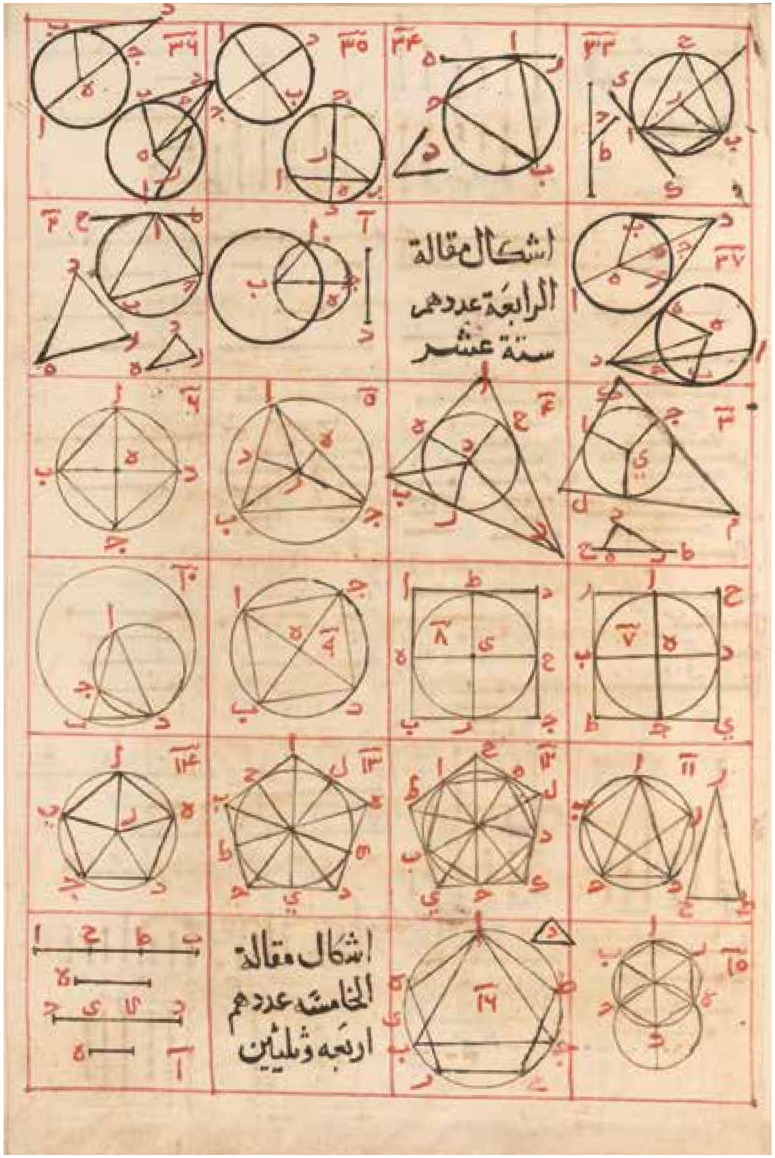
Mathematician and astronomer Mūsá ibn Muḥammad Qāḍī'zādah's commentary on Shams al-Dīn al-Samarqandī's (c. 1250—c. 1310) *Ashkāl al-ta'sīs*, an explication of Euclid's 35 geometrical propositions. Samarqandī's original text is written in n red ink and Qāḍī'zādah's commentary is in black ink. Mūsá ibn Muḥammad Qāḍī'zādah is famous for his contribution to the zīj al-sulṭānī (also known as the Zīj-i Ulugh Beg) (on display in the exhibit) containing the positions of 992 stars. His *Ashkāl al-ta'sīs* was meant to be read in preparation for reading Ptolemy's astronomical treatise the *Almagest*. This book is dedicated to Ulugh Beg (22 March 1394—27 October 1449), the Timurid Sultan and renowned mathematician and astronomer who built the Ulugh Beg Observatory in Samarqand (1424- 1449). The observatory ceased to operate in 1449 (following Ulugh Beg's death), so this would have been a distant cultural memory for the 17th c. copyist.

MS Or 64, Yazdī, Muḥammad Bāqir Zayn al-ʿĀbidīn, active 17th century, *Fī bayān al-murabbaʿāt*, [Iran?], Copy completed in Ramaḍān 1047 A.H. (Jan./Feb. 1638).
RBML, Presumed to be a gift of David Eugene Smith, 1931-1934

This is a super-commentary written in Arabic by Persian mathematician Muḥammad Bāqir Zayn al-ʿĀbidīn Yazdī (active seventeenth century) on al-Ṭūsī's *taḥrīr* of the *Elements*. On display here is a commentary on one of the portions of text that al-Ṭūsī substantially revised: al-Ṭūsī's proof of the Pythagorean theorem included many additional cases not explored in Euclid's original version. Moreover, the standard proof which appears in Euclid is on the previous page (22r) and contains only light marginalia, while the commentary on al-Ṭūsī's additions are among the most commented upon sections in this book. You can see the commentaries upon commentaries in the margins, facing different directions, and even fit in between the lines of notes. This copy was completed Ramaḍān 1047 A.H. (Jan./Feb. 1638) and includes records of ownership and reading at the beginning of the book. There is also an ownership stamp dated 1312 AH/1894 CE that is also present in a number of other editions of Euclid in Arabic on display indicating they likely came from the same collection and were acquired together.

This copy of a super-commentary of Ṭūsī's translation in Arabic was likely made in the late nineteenth century, highlighting the sustained relevance of this commentary and manuscript tradition. This copy is written in naskh in black ink with marginal notations in nastaʿliq. It includes numerous inserted notes and rough diagrams and notes on the inside in multiple hands suggesting it was used by multiple students before being presented to Eugene Smith by "Dr. Sadiq" on April 8, 1933 in Iran.

MS Or 49, Uqlīdis, Euclid, *Kitāb Uṣūl al-handasah wa-al-ḥisāb*, [between 1830 and 1899?]. RBML, Gift of David Eugene Smith, 1931-1934



This manuscript, dated roughly to sometime in the 16th or 17th c., does not appear in any catalog outside of Columbia and the possibility that it is a forgery cannot be excluded. This is a lavishly illustrated copy that includes many three dimensional diagrams, drawn and shaded in perspective. It is also neatly written with voweling and internal numbering, but no clear signs of student use despite addresses to “O student of the science of geometry.” The more typical constructions are included as compiled inserts which suggest they are illustrative rather than functional. There appears to be no other extant copies nor any other works associated with Reverend Eleazar mentioned in the title (‘An Excavation of the foundations from the composition of Reverend Eleazar’). Moreover, red decorative crosses appear throughout the manuscript as markers, separators, and more decorations further suggesting a possible connection to the Christian Arabic tradition. The work begins by praising Euclid for providing the sturdy foundations of geometry and censuring “scholars from among the Arabs”, for picking his work apart and leaving his *Elements* and these foundations disordered. The author ends his work with an address to “O student of the science of geometry” once again criticizing those who continue in the commentary tradition of “al-Ṭūsī and others’’ make themselves obscure, whereas, if one does not come from the exegesis [but the text itself] then it will be scientific and practical. On display are definitions and corresponding examples that describe a dodecahedron (or 12-sided solid, as seen in Figure ف) and an icosohedron (or 20-sided solid, as seen in figure لا and this window).

MS Or 309, *Ḥafīrat al-ta’sīs min ta’līf al-Qass Alī‘āzar*, [al-Qass Alī‘āzar?], ca.1500-1600. RBML, Gift of George Arthur Plimpton, 1936

PLIMPTON 513 1533 Eu23, Euclid, *Eukleidou Stoicheiōn bibl. IE : ek tōn Theōnos synousiōn*, Basel, 1533, RBML

This is the first printed Greek edition of Euclid's *Elements of Geometry* (1533) which became the basis for future translations until the nineteenth century. It was prepared by the German theologian Simon Grynäus (1493-1541) based on two Greek manuscripts and the 1505 Latin translation (on display). This edition also includes a copy of the neoplatonist Proclus' (412-485) extensive commentary on Euclid. Proclus claimed that geometry first arose before Euclid in ancient Egypt in order to make yearly "measurement[s] of land" and redefine property boundaries after flooding and continued to be improved upon over the centuries. While Proclus' neoplatonic philosophy resonated with European audiences, many found Proclus' history of the criticisms of Euclid, including Proclus' proposal to rewrite the *Elements* omitting parallel postulate completely, to be unsettling and incompatible with Renaissance humanist ideals of knowledge.

PLIMPTON Goff E113, Euclid, *Elementa geometriae*, Tr: Adelardus Bathoniensis. Ed: Johannes Campanus, With a dedicatory letter by Erhard Ratdolt, Venice, 25 May, 1482. RBML

This is the first printed edition of Euclid's *Elements of Geometry* (Venice, 1482). It reproduces the first Latin translation to be made in Europe, from Arabic by the English natural philosopher Adelard of Bath (c. 1080–1152). This was also the first 'complete' edition of Euclid's *Elements* available in Europe, as European scholars only possessed fragments of the Greek. This manuscript was edited by Italian mathematician and physician Johannes Campanus of Novara (c. 1220–1296) who produced a new Latin translation after consulting Latin translations of Arabic and Greek commentaries of Euclid. It is Campanus' translation of Euclid's *Elements* that we see here and that remained the standard translation for centuries until the sixteenth century (if not longer) when complete Greek manuscripts became available as Greek scholars fled Constantinople after the fall of the Byzantine Empire and conquest of the city by the Ottoman Empire in 1453.

Adelard of Bath made three translations. The first contains 15 books based upon al-Ḥajjāj's Arabic translation. The second whose propositions were worded differently, often lacked full proofs, and is speculated to be from an unknown Arabic source. The third was a commentary and not strictly a translation. While Adelard spent most of his life in England, Adelard learned Arabic and acquired scientific manuscripts while traveling for seven years around Northern Africa, the Mediterranean, and Asia Minor. Adelard also translated al-Khwārizmī and was one of the first scholars to introduce the Hindu-Arabic numeral system to European audiences.

SMITH 513 1505 Eu2, Euclid, *Euclidis Megaresis philosophi platonici Mathematicaru[que?] disciplinarũm*, Venice, 1505 (copy masterly bound, with gilt, gauffered edges), RBML

This is the first printed Latin translation of Euclid's *Elements* to be translated from Greek by Italian mathematician and humanist Bartolomeo Zamberti (1473-1539). Zamberti corrected the errors in and attacked Johannes Campanus's (c 1220–1296) edition and also consulted and included additions from the Greek mathematician and editor of the *Elements*, Theon of Alexandria (c 335–405); the author of [XIVth] book, Hypsicles of Alexandria (c. 190–120 BCE); Greek mathematician and astronomer Pappus of Alexandria (c. 290–350); and one of Proclus' students, Marinus of Neapolis [Palestine] (c 450-500). As was common in the medieval period and Renaissance, this manuscript falsely attributed *The Elements* to the Greek Socratic philosopher Euclid of Megara (c. 435–365 BC) rather than Euclid of Alexandria (c. 325-265 BC). The origins of this misattribution are unknown, however, it moved the 'birth' of geometry across the mediterranean when Alexandria was under the rule of the Mamluk Sultanate.

Moreover, in the Renaissance there were ongoing attempts to harmonize Platonic philosophy with Christianity, allowing ancient "heathen" authors who did not know God to still be venerable sources of truth. This synthesis is further shown by the image on the title page; this is a 'printer's device' or illustration identifying the printer's work from the Italian printer Giovanni Tacuino

(1482-1541). It is an illustration of St. John the Baptist, pictured with a lamb and the last words he spoke before he baptized Jesus "ecce agnus dei" or "behold the lamb of god." This illustration was used first in a work Tacuino printed in 1502 by Psuedo-Dionysius the Areopagite (5th-6th century CE), the Greek, Christian Neoplatonic philosopher.

B515 Eu225 Folio, Euclid, *Euclidis ... Opera a Campano interprete fidissimotr.* Que Lucas Paciolus iudicio castigatissimo detersit: emendauit, Venice, 1509. RBML

Luca Pacioli (1445-1517) was an Italian mathematician and Franciscan friar known for his *Summa de Arithmetica Geometria Proportioni & Proportionalita* (1494) that offered a comprehensive overview written in Italian of all mathematics known at that time in Europe including algebra and merchant arithmetic from the different Italian states--including the first published description of double-entry book keeping in Europe. Pacioli attacked Zamberti's translation of the Elements and defended the purity of Campanus' earlier edition (both on display). Nonetheless, Pacioli's Elements contains many of his own annotations. Each of the 15 books (following Campanus' edition) lists each proposition, usually followed by his "Correction" and often a demarcated quote from "The Words of Campanus." Like the Venice 1505 edition of Euclid on display, the title lists "Euclid of Megara (c 435-365 BC) instead of "Euclid of Alexandria" (c 325–265 BC).

Pacioli was also a close friend and collaborator of Leonardo da Vinci who illustrated his work on proportions and applications to geometry, art, and architecture, ***Divina proportione*** (1509). He was trained in the studio of Renaissance artist Piero della Francesca (1415-1492) and briefly lived with the humanist-artist Leon Battista Alberti (1404-1472). Pacioli spent most of his life as a tutor and professor at courts and universities across Italy. All of his works were published in Venice, including his new latin translation of Euclid's *Elements* featured here.

PLIMPTON 513 1594 Eu23 Folio, Euclid, *Kitāb taḥrīr uṣūl li-Ūqlīdus* / min ta'līf Khawajah Naṣīr al-Dīn al-Ṭūsī, [Rome], 1594, RBML

This is the first printed edition of Euclid in Arabic printed by the Medici Oriental Press in Rome in 1594. All marginal commentaries have been omitted. This work also contains the Ottoman Sultan's privilege, issued in the name of Pādishāh-i Islām al-Sulṭān ibn al-Sulṭān al-Sulṭān Murād Khān (r. 1574-1595), and dated Dhū al-Ḥijjah 996 AH in Constantinople (1588 CE). The printer likely sought approval from the Ottoman Sultan in order to sell copies throughout the empire. It had an ambitious initial print run of 3000, although only half of these were sold indicating that this was a commercial disaster. While the edition was intended for Arabic speaking and reading audiences, due to lack of demand it was almost exclusively bought and used within Europe by scholars learning Arabic.

2269.3146.389 1880, Euclid, *Taḥrīr Uqlīdis fī 'ilm al-handasah*, Tehran, [1881]. COLLECTION: Hathi trust, digitized from Princeton University Libraries

This is a lithograph printing of al-Ṭūsī's translation of the *Elements* (Tehran, 1881), referenced in the letter to Eugene Smith on display as the second printed Euclid in Arabic after the 1594 edition (also on display). While in Europe, lithography was mostly used for book illustrations, it was used to reproduce entire texts in Arabic and Persian, written by hand. This allowed many of the distinctive features of the Islamic manuscript tradition to be reproduced in a widely disseminated printed form. Here we see some of the lavish flourishes as well as marginalia reproduced on the first page of this edition of Euclid. The margins of this edition are populated with diagrams, recitation notes, and minimal commentaries throughout.

This is referred to in the letter to Eugene Smith as the second printed Euclid in Arabic after the 1594 Rome edition. We now know this to be false. This is the sixth printed edition of Euclid in Arabic–the fifth outside of Europe (Istanbul, 1801; Calcutta, 1824 (on display); Lucknow, 1873–1874; Delhi, 1873–1874; Tehran, 1881).

Despite the technology being available (and much to the dismay of the Medici Press), the movable-type printing press and its products did not have the explosive adoption in the Islamicate world as it did in Europe. However, with the transition to lithographic book production techniques in the early nineteenth century, the technique was widely adopted and almost completely replaced all typographic printing in Morocco, Iran, Central, South, and Southeast Asia.

OL 21520.15, Euclid, *Kitāb Taḥrīr al-Ūqlīdis lil-Ṭūsī*, Kalkatah: al-Maṭbaʻah al-Hindīyah, 1824. Hathi Trust Collection, digitized from the collection of the HARVARD Repository,

The Calcutta School-Book Society was founded in 1817 with the goal of making educational books available in English and asiatic languages in British-ruled Bengal. Acknowledging an edition in Persian might have been more "useful," Reverend Thomas Thomason produced a new print edition of Euclid in Arabic for the Society. It would be based upon the al-Ṭūsī version who he claimed had enriched the manuscript and provided the most authoritative Arabic translation of Euclid. Nonetheless he insisted on the importance of printing Euclid "stripped of its appendages, that is, of all that is not Euclid's…and exhibit the work in as clear and perspicuous a form as possible for the greater assistance of native students" (Thomason 1820, p. 234). On display is the first page of Euclid's *Elements*, in Arabic, but presented in a format that mirrors the standard English edition with its clearly distinguished definitions, axioms, propositions, and proofs. In contrast to the other editions of Euclid in Arabic on display, the text is bare and has been artificially fit into English textual formatting conventions. None of al-Ṭūsī's additions, omissions, or revisions appear in this version.

Moveover, unlike every other edition (including the 1594 Rome print edition and the Christian manuscript) in Arabic, this work does not begin with the 'bismillah' ('in the name of Allah') that without exception begins every book, even 'scientific' or non-Islamic ones like Euclid. It is also stripped is every "allāhu ʾaʿlam" ("only god knows", literally "God knows best') which could often end proofs and commentaries; these changes had epistemic and not simply cultural consequences. His edition begins with "hadud" or definitions, listed in order, rigidly separated, with no contextualizing preface, notes to the reader nor commentaries that might place this work in dialogue with other works and traditions. As other items in this window make clear, these "appendages" were an essential part of the transmission of knowledge across the Islamicate world. By contrast, here, the reader must accept these opening definitions as they are in order to continue. This edition resembles the *Elements* that students use in classrooms across the world today.

SMITH 513 Eu22, Gartz, J. Christoph, *De interpretibus et explanatoribus Euclidis arabicis schediasma historicum*, Halle, Gartz, J. Christoph, Halle (Germany), 1823. RBML

German mathematician J.C. Gartz's "On the Arabic Interpreters and Commentators of Euclid" became the standard reference work for scholars, mathematicians, and collectors on the topic and was likely used by the collectors of the manuscripts in this collection as a guide. As philologists in the later nineteenth century codified the "authoritative" edition of Euclid's *Elements* (still in print today) and its history, Gartz' reference work became a gestural footnote to the manuscript traditions of Euclid in Arabic. To Gartz and his contemporaries, this tradition on the one hand might have clues as to the nature of the modern developments of non-Euclidean geometry, while on the other hand, could remain firmly rooted in a Classical past whose achievements may be significant, but ultimately could be dismissed.

On the title page of German mathematician J.C. Gartz's "On the Arabic Interpreters and Commentators of Euclid" we see a quote from the famous mathematician and historian of mathematics Jean-Étienne Montucla that laments that those with a "taste" for Arabic literature do not have a taste for mathematics and those with a taste for mathematics do not have a taste for Arabic literature. Gartz uses the philological methods very much in vogue in the German university system in order to collect all references to Euclid in Arabic manuscripts from catalogs of libraries across Europe that had been collected, categorized, studied, and (more often) forgotten by 'Orientalists' since the seventeenth century. Gartz begins with a "division" of mathematics among the the "Orientals," what the Arabs…"wrote", "teach," and "judge," Gartz' own "judgment of this tradition," then gives a history in "general [universum] chronological order" before providing an alphabetical author catalog. The entry on "Doctor Naszir-Eddin Al-Thusi" is particularly detailed; it claims that he was a"mild and modest" man who spent his youth traveling and reading Greek books. The evidence, however, only supports that al-Tusi read Greek works in Arabic translation.

Gartz' only other known works are the mathematical entries of an unfinished german encyclopedia of the sciences and arts and a mathematics textbook based upon his university lectures (1820) in which he aimed to present Euclid's views on magnitudes in a way more appropriate to the "spirit of the new mathematics" including references to modern views on the subject. Ideas about what would later become termed as "non-Euclidean geometry" by German mathematician Felix Klein (1871) were being circulated and studied at German universities at the time of Gartz' writing. Gartz' research into the Arabic transmission fit within the context of contemporary mathematical research agendas into the foundations of geometry and within new philological research agendas to codify a 'german' style of philology and orientalism. While for several centuries Mathematics was considered the "Queen of the Sciences," in the nineteenth century this title was usurped by Philology across European universities. Felix Klein, although a mathematician, was an advocate for this change and had many close associates who were Orientalists.

Icosahedron, Greco-Egyptian, Ptolemaic period, Smith Instruments 27-651, Gift of David Eugene Smith. RBML

This twenty-sided die dates to Ptolemaic Egypt, roughly the same period as Euclid himself. Euclid defines icosahedrons as "a solid figure contained by twenty equal and equilateral triangles" in Book XIII of his *Elements*. It is one of the five "Platonic solids" or convex, regular polyhedra in three-dimensional Euclidean space along with the Tetrahedron (four-faces), Cube (six-faces), Octahedron (eight-faces), Dodecahedron (twelve-faces), and Icosahedron (twenty-faces). These geometrically harmonious figures took on mystical meanings and were used to model and evince the sacred, yet mathematical nature of the cosmos. This was likely used as a die for divination or playing games. ❖

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Islamic Astronomy

As the Islamic empire flourished from the 7th c. onward, spanning vast swaths of land and expanding across Southern Europe, the Middle East, North Africa, and Southeast Asia, Islamic societies saw an unprecedented number of scientific and technological advancements. Pre-existing ancient sciences that Islamic civilization drew from included the Babylonian, Greek, Indian, and Persian traditions. The majority of translations from Greek into Arabic occurred during the 7th to 10th centuries against the backdrop and needs of varying social, economic, and political conditions: even the earliest Islamic astronomers critically assessed and engaged with various parameters and values found in the Greek original texts, and went beyond mere translation. One of the most important astronomical texts that was translated from Greek into Arabic was Claudius Ptolemy (2nd c.) of Alexandria's *Almagest*.

Several aspects differentiate Islamic astronomy from previous traditions: first, there was a deep interest in the consistency and universality of physical models. This interest was twofold: Islamic astronomers were concerned with the instrumentation and observational standards and within their general explanations of the universe. Second, the study of astronomy was motivated by its religious and practical applications, such as its ability to provide precise scientific solutions to the qibla determination (the direction of Mecca for daily prayers), and the determination of the new crescent Moon for the lunar calendar, regardless of location. Much of these religious applications relied on the astrolabe. This instrument could be carried anywhere and contained trigonometric functions and displays of the qibla for cities, and basic computations. During the 9th to 11th centuries, new methods of observation and instrumentation led to remarkable developments which paved the way for universal astrolabe plates, which could be used anywhere.

The Study of Astrology

The relationship between astronomy and astrology deserves an explanation, and must be assessed within its historical context: astronomy and astrology were initially connected under the general category of the "science of the stars" (ʿilm al-nujūm), and the latter was seen as an application of the former. By the 9th to 10th c., a clearer definition emerged and three inter-related, but separate disciplines or genres emerged:ʿilm al hayʾa (lit. science of the configuration of the entire universe), ʿilm al-nujūm (lit. science of the stars), and ʿilm aḥkām al-nujūm (lit. science of the judgments of the stars). The first consisted of theoretical sciences, whereas the latter constituted astrology.

Although today astrology is often discredited as "unscientific", it is worth noting that astrology held a high level of prestige in the ancient and Islamic worlds. Astrologers, or *munajjimun*, needed solid understanding of the mathematical and astronomical calculations for their astrological analyses and predictions. Astrology also carried political and daily significance for determining auspicious timings. *Munajjimun*, astrologers, were sometimes employed by rulers to help advise them on horoscopes, determining times of auspicious events, or whether they should enter a battle. For instance, caliph Al-Manṣūr (712 A.D.–775 A.D.) consulted with his court astrologers, most notably Nobakht, on where to build his famous grand city, Baghdad. Horoscopic astrology was also consulted for life defining events, succession matters, when to conceive children or whether or when to enter into political or military battles.

Some of the earliest astronomical texts produced included zījes: these are elaborate handbooks with chronological and astronomical as well as trigonometric tables, detailing equations of time, planetary positions, and information about the fixed stars. Zījes typically started with tables which mapped and converted various calendars (including: solar and lunar, Gregorian, and other calendars), mapped geographic locations and time, and stated where and when the manuscript was produced. Many Zijes were commissioned under impressive star observation (rasd) programs, sometimes over many years and gathered tremendous amounts of data. Zijes became popular aids to set time and dates across space and time for those unable to afford the new instruments (astrolabes, etc.). In our collection, MS or 1, the zīj i-Sulṭānī was the product of persistent observational pursuit at the Samarqand observatory and is an exemplar of a collaborative effort of multiple astronomers.

Islamic astronomers made many contributions in observational astronomy and instrumentation, e.g., the astronomer ʻAbd Al-Rahman al-Sufi (903-986), systematically corrected and expanded Ptolemy's *Almagest* into his magnum opus: *The Book of the Constellations of the Fixed Stars* (*kitāb suwar al-kawākib*). He identified the magnitudes and positions of over one thousand stars and critiqued Greek and Arab astronomy based on his own stellar observations (MS 442). In theoretical and observational astronomy, notably under the Maragha Observatory, Nasir al-Din al Tusi (d. 1274), Mu'ayyad al-Din al-Urdi and their students developed mathematical theorems such as the Tusi couple and Urdi Lemma. Nasir al-Din al Tusi's astrolabe treatises, which include twenty chapters on the construction of the astrolabe and Maḥmūd ibn Muḥammad al-Jighmīnī (12/13th century) al-Mulakhkhaṣ fī al-hay'a al-basīṭa (Epitome of plain theoretical astronomy), were widely studied and taught. Other manuscripts on display here, e.g.the annotations of astronomer John Greaves (B520.9 UL8), demonstrate the far ranging and wide reach that the Islamic astronomical tradition influenced.

Here we see a zīj (handbook of astronomy with tables for calculation) from Ulugh Begh (d. 1449). Ulugh Beg was a mathematician, astronomer, governor of Transoxiana and Turkestan and, briefly, a Timurid Sultan. Some of the subjects include chronology, trigonometry, spherical astronomy, planetary positions, and astrology. It serves as a catalog of the positions of a thousand fixed stars with updated precessions and unprecedented accuracy.

The introduction of zīj i- Sulṭānī is composed of notes from the collaborative efforts of astronomers Qāḍīzāde al-Rūmī, Jamshid al-Kāshī, and ʿAlī Qūshjī, who conducted observations for the astronomical tables. The zīj i- Sulṭānī contains observational and computational information within its tables. This includes the sine table, which spans many pages and shows the use of a sexagesimal system, a numeral system with sixty as its base. The values are calculated through quadratic interpolation. The zīj i-Sulṭānī circulated as late as the nineteenth century and included many commentaries by astronomers across multiple regions, including British and French astronomers from the 17th century onward.

MS Or 1, Ulugh Beg, 1394-1449, [Zīj-i sulṭānī], copy of the astronomical tables of Ulugh Beg with instructions on calendar conversions, stars and their positions, 1836. RBML

MS Or 48, Bīst bāb dar ʻilm-i usṭurlāb, 1817, RBML

The Columbia Rare Manuscript and Books Collection has two treatises on the polymath Naṣīr al-Ṭūsī's (d. 1274) astrolabe. MS Or 48 is an abridgement of the Bīst bāb dar maʻrifat-i usṭurlāb by Naṣīr al-Dīn Ṭūsī. Prior to the advent of modern technology, the astrolabe was the equivalent of a pocket computer for timekeeping, mathematical calculations, and astrological predictions. Here, we see a Persian copy of Tusi's famous astrolabe treatise. In this treatise, al-Ṭūsī explains how to build an astrolabe and its various uses for astronomical geography and timekeeping. The astrolabe is a portable instrument, often made of brass, on which the positions of the sun and some stars are projected. The azimuthal lines on the plate of an astrolabe measure the direction of the sun or the stars. For the Islamic astronomers, the astrolabe precisely measured time during the days and nights, across latitudes, geographic locations, and seasonal changes.

MS Or 10, Ṭūsī, Naṣīr al-Dīn Muḥammad ibn Muḥammad, 1201-1274, Mukhtaṣar-i Bīst dar maʻrifat-i usṭurlāb, 1299, RBML

MS Or 442, Ṣūfī, ʻAbd al-Raḥmān ibn ʻUmar (903-986 CE), Kitāb-i Ṣuwar al-kawākib, 1700. RBML

Abu al-Husayn ʻAbd Al-Rahman al-Sufi (903-986 CE), known also by his Latinized name of Azophi, systematically corrected, revised, expanded, and updated Ptolemy's *Almagest* in a major book entitled *The Book of the Constellations of the Fixed Stars* (*kitāb suwar al-kawākib*). It was completed around 964 CE. Building on and critiquing both the Greek and the indigenous, Arab-folk astronomical heritages, al-Sufi listed Arab star names, magnitudes, and two drawings of each constellation, one as it is seen in the sky and one reversed right to left as it would appear on a celestial globe. Al-Ṣūfī's work is also defined by an unprecedented breadth of stellar observations and precise magnitudes. He describes forty-eight constellations, identifies the magnitudes and positions of over one thousand stars, and critiques Greek and Arab observations based on his own stellar observations. He details critiques for each of the 1,025 stars in Ptolemy's *Almagest*. Al-Ṣūfī was the first to recognize the Andromeda Galaxy as its own nebulous cluster (M41). Moreover, al-Ṣūfī's book is an important source for understanding Arabic star nomenclature and many of the star names mentioned in his catalog remain with us today.

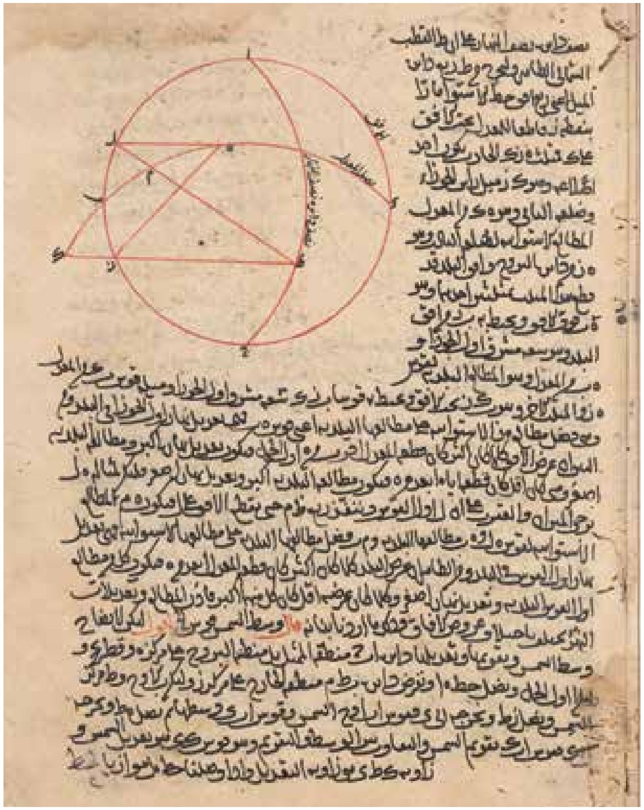
According to Paul Kunitzsch, the German authority on Arabic star names, "local tradition of the peoples of Islamic lands in the Arabian Peninsula and in the Middle East had their own names for various bright stars such as Aldebaran, and they commonly regarded single stars as representing animals or people. For example, the stars we know as Alpha and Beta Ophiuchi were regarded by them as a shepherd and his dog, while neighboring stars made up the outlines of a field with sheep. Some of the Arabic names were already so many centuries old that their meanings were lost even to al-Ṣūfī and his contemporaries, and they remain unknown today. Other star names used by al-Ṣūfī and his contemporaries were direct translations of Ptolemy's descriptions. For example, the star name Fomalhaut comes from Arabic meaning "mouth of the southern fish," which is what Ptolemy had described it as in the *Almagest*. Al-Ṣūfī did his own brightness and magnitude estimates, which frequently deviated from those found in Ptolemy's work. He identified the Large Magellanic Cloud, which is visible from Yemen, though not from Isfahan in the center of Iran where he worked; it was not seen by Europeans.

This treatise describes the configurations of the celestial and terrestrial realms and offers many descriptions of the orbs. It is noteworthy that some leaves in the copy are left empty to allow for illustrations to be filled in later on, testifying to the elaborate production of these manuscripts. Scribes wrote the text first, leaving empty pages for illustrators to fill in later on. Jaghmīnī's text highlights the continuous conversation between scholars across temporal and regional periods of the Islamic tradition of astronomy. On display are the depictions of the orbits of Venus, Earth's moon, and Mercury in red and black ink.

Jighmīnī was an astronomer fromthirteen century, Khwārizm in Central Asia, who wrote the influential elementary astronomical text on display, *al-Mulakhkhaṣ fī al-hay'a al-basīṭa* (Epitome of plain theoretical astronomy). This simplified introductory astronomical text falls within the genre of ʿilm al-hay'a, or theoretical astronomy, a corpus of works that attempted to explain the physical structure of the universe as a whole.

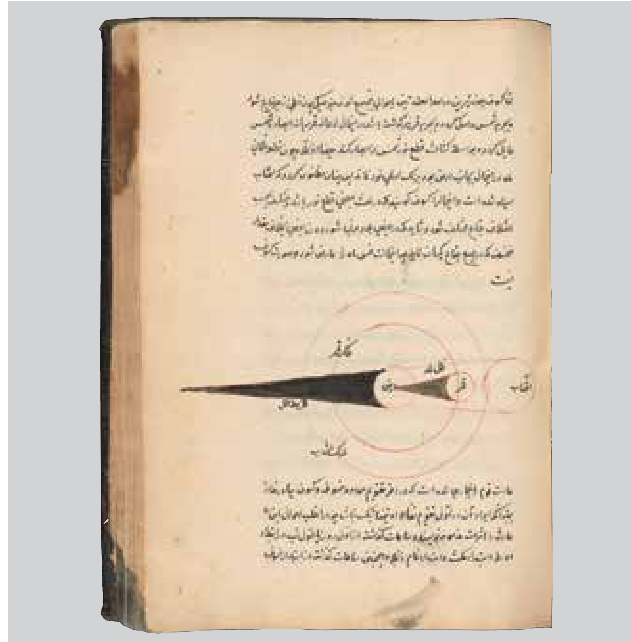
Jighmīnī's text became the subject of an astonishing number of commentaries and supercommentaries in Arabic and Persian which played a crucial role in the teaching, dissemination, and institutional instruction of Islamic astronomy well into the 19th century. According to Sally Ragep: "The target audience of Jaghmīnī's Mulakhkhaṣ was, in the first instance, students studying in madrasas, where his work would have been seen as providing a cosmology glorifying God's creation. The more general issue raised here is whether the standard approach to the pedagogy of Islamic science tends to promote its history as discrete episodes and dependent in the main on courtly patronage or individual initiatives, i.e., outside the core institutional structures of Islamic societies. A serious consequence of this has been the neglect of the vital role religious institutions played in sustaining scientific education in premodern Islam": **https://escholarship.mcgill.ca/concern/theses/hm50tv56f**.

MS Or 21, Jighmīnī, Maḥmūd ibn Muḥammad, al-Mulakhkhaṣ fī al-hay'ah, 1500, RBML



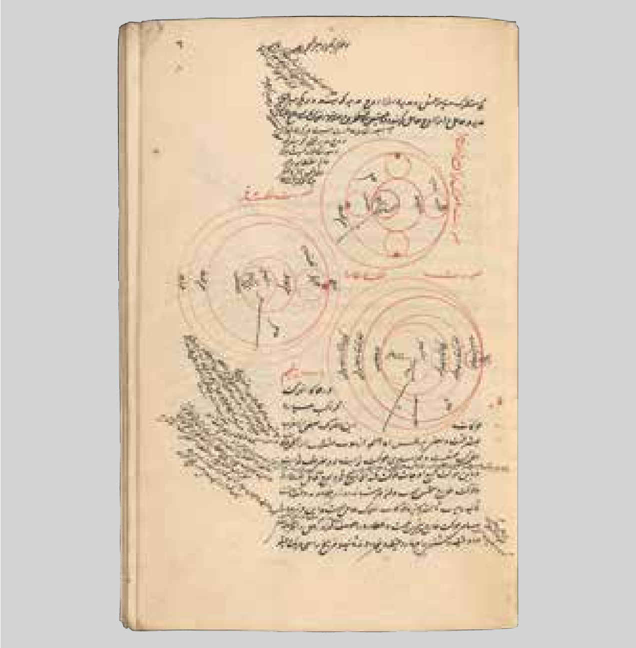
MS Or 148, Turkumānī, Kamāl al-Dīn, Risālah fī al-hay'ah al-falakīyah, 1401. RBML

MS 148 is a commentary on l-Jaghmīnī's astronomical work Mulakhkhaṣ fī ʿilm al-hay'a al-basīṭa by the writer Kamāl al-Dīn al-Turkmānī. Turkmānī was born in Cairo, (Egypt) in 1314. Al-Turkmānī offered his commentary to the Mongol ruler Jānī Beg Khan (must be another date from the 14th century). The commentary was used to study the fundamentals of theoretical astronomy across linguistic and cultural contexts. The commentary culture on al-Jaghmīnī's astronomical text continued well into the 17th century.



MS Or 26, [Two works on astronomy in Persian],1828. RBML

Naṣīr al-Dīn al-Ṭūsī (d. 1274) was a renowned scholar who made major contributions to all branches of sciences, especially astronomy and mathematics. Al-Ṭūsī wrote over one hundred and fifty works, mostly in Arabic and Persian, that dealt with Greek science, theology, and law. Al-Ṭūsī was also known as the director of one of the most important astronomical observatories in Maragha (Iran).The manuscript on display has two collated texts of al-Ṭūsī's text on calendars (Sī faṣl fi maʿrifat-itaqvīm) and the astronomer al-Birjandi's (d. 1528) Dar maʿrifat-i taqvīm mushtamil bar sī faṣl. Al-Birjandi wrote numerous astronomical commentaries and supercommentaries on the works of Naṣīr al-Dīn al-Ṭūsī, including his work on theoretical astronomy and astrolabe. The page on display is a diagram of a natal zodiac.



MS Or 298, Risālah dar hay'at. [Sharḥ-i Risālah dar hay'at], An astronomical treatise by al-Qūshjī (d. 1474) and a commentary on it by Muṣliḥ al-Dīn al-Lārī, 1700. RBML

MS Or 285,[Collection of works on astronomy and astronomical instruments],1694

On display here is a volume bringing together ʿAlī Qūshjī's *Risāla dar ʿīlm al-hayʾa*, (which was originally written in Persian in Samarqand in 1458 (and a commentary on Qūshjī's *Risāla* written by the scholar Muṣliḥ al-Dīn al-Lārī (d. 1572). Qūshjī's Risāla was translated into Arabic, Sanskrit and Turkish, under the title of al-Fatḥiyya fī ʿilm al-hayʾa, Qūshjī presented this work to Sultan Mehmed in 1473 during his campaign and victory (hence *al-Fatḥiyya*, meaning related to victory) against the Aqqoyunlus. This astronomical work was widely used among Ottoman madrasa students and scholars. One of Qūshjī's major contributions includes the assertion that scientific disciplines should be freed from principles of Aristotelian physics.

This is a collection of works on astronomy and scientific instruments collected by Yūnus ibn Aḥmad al-Dajānī. It contains the works of Qusta ibn Luqa (d.912), Abu Ali al-Hassan al-Marrakushi (late thirteenth century), Sibṭ al-Māridīnī (d. 1495), and many other major astronomers and mathematicians. Subjects explored include: how to use the sine quadrant and astrolabes, the fundamental principles of timekeeping (ilm al-miqat). Some of the other collations include basic calendrical calculations and descriptions of astronomical instruments. MS OR 285 highlights the use of astronomy for religious applications. In particular, it discusses the computation of the times for the five daily prayers and references the hadith and other Islamic sources which had defined the times of the prayers.

Set of works on mathematics and astronomy copied in what appears to be the same hand and bound together. The second work has a supercommentary copied in the margins. Several leaves of calculations and notations are tipped or laid in; two tipped in pages have been foliated along with the leaves (f. 26, 33). Also includes one page in Ottoman Turkish (f.94v).

This is a set of works on astronomy and mathematics bound together by the same hand in Arabic with one page in Turkish. The works include multiple planetary diagrams in red and black ink with commentaries laced in the margins throughout the text. There are multiple pages with calculations, tables, and notations. The commentator Mūsá ibn Muḥammad Qāḍī'zāda al-Rūmī (circa 1436) is most famously known for his commentary on al-Jaghmīnī's introductory astronomical text al-Mulakhkhaṣ fī al-hay'a al-basīṭa (Epitome of plain theoretical astronomy).

Mūsá ibn Muḥammad Qāḍī'zāda was born in Bursa (modern day Turkey) and died in Samarkand (modern day Uzbekistan). According to contemporary sources?, Mūsá ibn Muḥammad Qāḍī'zādah "presented himself to the Samarkand court of the very promising Ulugh Beg (1394-1449), who later became Qāḍī Zāda's pupil and assured him the funds for a life of study in Samarkand." This simplified introductory astronomical text was the subject of many commentaries, such as the one on display.

MS Or 307, Kitāb fī sharḥ al-Mulakhkhaṣ. RBML

B520 P95 13V Folio, Ptolemy,, Almagestu[m] Cl. Ptolemei Pheludiensis Alexandrini astronomo[rum] principis:Translated from the Arabic, itself a translation of the original Greek.;Errata statement on leaf [2] verso, [Venice] : anno Virginei partus. 1515. die. 10. Ja.;Venetijs ex officina eiusdem litteraria., [1515]. RBML

Here on display is a Latin edition of *Kitab al-Magest* translated from Arabic, which was itself translated from the original Greek. Gerard of Cremona' s translations were significant for the transmission of Islamic science to other intellectual traditions and in ushering in the European Renaissance.The famous translator Gerard of Cremona (d. 1187) traveled to Toledo to learn Arabic, in order to translate Ptolemy's *Almagest*. His Latin translation of *Almagest* from 1175 appeared in print in 1518

Cremona was "the most industrious and prolific of all [the] translators from the Arabic" and "more of Arabic science in general passed into Western Europe at the hands of Gerard of Cremona than in any other way" (Haskins (1927), pp. 286-287). Heading a group of translators in Toledo, Cremona and his team are credited with about eighty translations from Arabic into Latin.

B520.9 UL8, Ulugh Beg, Epochæ celebriores, astronomis, historicis, chronologis, chataiorvm, syrogræcorvm, arabvum, persarvm, chorasmiorvm, usitatæ, ex traditione ulug Beigi, indiæ citra extráque Gangem principis, eas primus publicavit, recensuit, et commentariis illustravit Johannes Gravius, 1650. RBML

John Greaves (1602-1652) was an astronomer, Orientalist, and the Savillian Professor of Astronomy at Oxford University. Greaves collected many Arabic and Persian manuscripts that he sent to the Archbishop Laud and Oxford. One of these included an Arabic copy of Ptolemy's *Almagest*, which remains unfound. He annotated many editions of astronomical texts in Latin, Arabic, and Persian. On display are Greaves' annotations for the astronomical tables from Ulugh Beg (also see MS or 1). In the manuscript margins, he annotates scientific terms such as apogee and zodiac. The astronomical tables from Ulugh Beg were significant for their observations and computational data. Greaves' engagement highlights how he was learning from these Arabic and Persian astronomical texts and disseminating the knowledge in his lectures at Oxford.

Astrolabe, Arab, undated. Smith Instruments 27-257, Gift of David Eugene Smith

An astrolabe is a two-dimensional map of the three-dimensional heavens. It is also an analog computer that allows the user to determine where a star will be at a given time on a given date, and make complex calculations without needing to do long arithmetical calculations.

It was used for many purposes, mainly for determining the time, judging altitude, finding direction, for instance to find the direction of Mecca from other locations, and for finding the position of celestial bodies at a particular moment in time. Some Muslim legends believe that the first astrolabe was invented by Hermes or the Prophet Idrīs. It was also used in mosques by the *muwaqqit* (time-keeper) for determining the exact astronomical time to alert the *mu'azzin* (caller for prayer) for summoning the faithful for prayers.

This fine early astrolabe traveled the world on loan to the American Museum of Natural History's exhibition "Traveling the Silk Road: Ancient Pathway to a Modern World," 2009-2013. It is made of brass and has a central lobe around which the interconnected circles rotate to indicate planetary and zodiac positions. The beautiful engravings in Kufic script were typical of 13th century astrolabes.

Astrolabe, Jaipur, 19th century. Smith Instruments 27-257a. Gift of George Arthur Plimpton

While this astrolabe is located in the Smith Instruments collection, it was owned by his dear friend and co-founder of the Friends of the Library of Columbia University, George Arthur Plimpton, and so is known as "Mr. Plimpton's Astrolabe."

This Sanskrit astrolabe is of Indian origin with provenance from Jaipur, Rajasthan, during the Rajput dynasty. It is most probably an invention of the Jantar Mantar observatory. The instrument is made of brass with several interlocking rings that are used to indicate planetary positions. The outermost ring has Indic numerals from 1-60 and the inner circles have the names of twelve Indian zodiac signs inscribed, eg. Mesh (Aries), Vrushab (Taurus), Mithun (Gemini), and so on. The title below the pierced ring in Devanagari script reads as "Shree Yantra Raj". The Shree Yantra is a form of mystical diagram used in the Shri Vidya school of Hinduism. Typically, it consists of nine interlocking triangles—four upward ones, which represent Shiva, and five downard ones representing Shakti (the Hindu deities). These triangles represent the cosmos and the human body. It is believed that the Muslim astronomer al-Bīrūnī had brought an astrolabe with him to India and taught its working principles to his Hindu interlocutors in Multan in the first quarter of the eleventh century. Hence, this astrolabe, though invention of an Hindu dynasty, bears overarching similarities with those astrolabes devised under Muslim dynasties.

The Sanskrit inscription on the *kursī* reads "the glorious astrolabe" suggesting that it could be a copy of the much more magnificent astrolabes made in Jaipur's famous manufacturing centers during the 18th and 19th centuries. This astrolabe is a "two-dimensional depiction of a celestial sphere using stereographic projection."

Zodiac, terra cotta, Egyptian, Smith Instruments 27-316.
Gift of David Eugene Smith

On display here is an Egyptian origin terracotta (Italian: baked earth) calendar from the Ptolemaic Alexandria ringed with symbols of the Greek Zodiac (named after the 12 Olympian Gods of Greek mythology). Starting from the bottom and reading clockwise, they are Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, Scorpio (a much older symbol), Sagittarius (using the symbol currently used by Scorpio), Capricorn, Aquarius, and Pisces. This terracotta piece was used by Greek scholars in Alexandria for their astronomical research. The Greek science of zodiac was embraced and perpetuated by Muslim scholars who devised several instruments, almanacs, and penned several treatises on prognostications based on this science.

Astrolabe & Quadrant, Lahore, signed by Lalah Bulhomal, [1839-1840 CE].
Smith Instruments 27-254. Gift of David Eugene Smith

As described by S. R. Sarma, this instrument "is filled with so much numerical data that it looks like a miniature encyclopedia rather than a handy tool." On the astrolabe side the important stars are inlaid in silver.

See: Sreeramula Rajeswara Sarma, Lalah Bulhomal Lahori and the Production of Traditional Astronomical Instruments at Lahore in the Nineteenth Century (Received 07 January 2015; revised 29 March 2015); https://archive.org/search.php?query=subject%3A%22617++++Lalah+Bulhomal+and+the+Production+of+Traditional+Astronomical+Instruments+at+Lahore+in+the+19th+Century+%282mb%29%22.

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Mathematical Sciences

The mathematical sciences occupied a prestigious position in the Islamic world. Between the 8th and 10thc., the Islamic world saw a massive "Graeco-Arabic translation movement" of not only Greek but also of Pahlavi, Persian, Sanskrit, and Syriac texts on a wide range of topics, but especially on the mathematical sciences including astronomy, astrology, and music. The works of Ptolemy (2nd c.), Euclid (3rd c.), Apollonius (3rd c.), Archimedes, Diophantus (3rd. c), were dynamically embraced and served as a basis for subsequent developments in the mathematical sciences in the Islamic world.

The traditional branches of the mathematical sciences as defined by Islamic scholars were: arithmetic, geometry, astronomy, and music. The categorizations within the mathematical sciences were constantly shifting and took on new meanings in new contexts; they included, at different times and in different combinations and hierarchies, the sciences of algebra, trigonometry, mechanics, and optics, but also 'applied mathematical sciences' such as engineering, 'war machines', chess strategy, finance, and certain 'occult sciences' like *lettrism* (*'ilm al-jafr*) and 'magic squares.' One of the most central contributions to the mathematical sciences is that of al-Khwārizmī (d. 850) who gave us the term 'algorithm.' Al-Khwārizmī wrote the first treatise on algebra (from the Arabic *al-jabr—to put together, to equate, to compare*)—in which he outlined the methods for solving linear and quadratic equations and provided solutions to commercial and inheritance problems (see MS Or 40). Muslim scholars made numerous contributions in solving geometric problems, and devising techniques of measurement and calculation, which had practical applications for imperial administration, devotional practices, legal matters ,commerce and personal finance. Muslim scholars also pioneered the fields of spherical geometry and of trigonometry (including the discovery of all six trigonometric functions). Moreover, knowledge of geometry was considered essential not only for students and scholars, but also for practitioners, including artisans, architects, engineers, land surveyors and imperial secretaries. Beyond its numerous practical applications for various sciences and professions, geometric knowledge and skill informed aesthetic sensibilities and techniques and came to define essential features of Islamic art. Basic as well as complex geometric principles undergird ornate geometrical decorations, arabesques and designs that adorn everyday objects, including luxury textiles and carpets, as well as architectural buildings, urban planning and even the design and ornamentation of books.

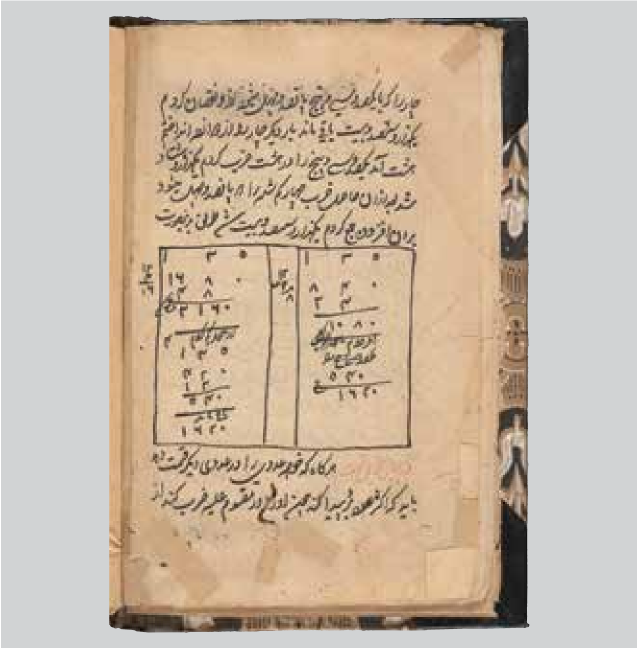
The Persian, Arabic, and Turkish manuscripts on display here highlight the productive diversity and effervescence of mathematical activity across the Islamicate world over many centuries. These manuscripts come from vast swaths of land (Southern India to Morocco) and cover a wide range of dates (13th c. to mid 19th c.). In their pages, we see the generative dialogue and interplay of distinct traditions, including North-African algebra texts, Sanskrit arithmetic methods, Greek theoretical geometry. The genres of mathematical knowledge featured are also diverse; theoretical treatises (MS Or 40), practical handbooks (MS Or 36), student textbooks (MS Or 33), compendiums (MS Or 45), and even poems (MS Or 50). The manuscripts also showcase the important role that mathematics played in communal and daily life (shipbuilding and canal digging (MS Or 36), inheritance division (MS 40), calendrical calculation (MS Or 51), music (MS Or 45), calculating the direction of daily prayer at different location (MS Or 46), and the continued vibrancy of the mathematical sciences within Islamic societies, well into the 19th c.

MS Or 40, Khuwārizmī, Muḥammad ibn Mūsá, active 813-846, al-Jabr wa al-*Muqābala*, [India?], Mardā abū al-Qāsim, scribe, 1700s, RBML, Gift of David Eugene Smith, 1931-1934

The Persian polymath *Abū Ja'far Muḥammad ibn Mūsá al-Khuwārizmī* (780-850 CE) is considered to have written the first treatise on algebra, *al-Kitāb al-Mukhtaṣar fī Ḥisāb al-Jabr wa-al-Muqābalah* (or The Compendious Book on Calculation by Completion and Balancing) around 820 CE. "*al-jabr*" and "*al-muqābalah*" refer to the two processes of balancing equations; "*al-jabr*" is the adding of a sum to both sides of an equation such that it is taken away from one side and added to the other, while "*al-muqābalah*" is the subtraction of a sum from both sides such that a sum is taken away from one side and subtracted from the other side to make them equal. The word 'algebra' comes from the Arabic al-jabr, and the word 'algorithm' derives from al-Khuwārizmī.

This is an eighteenth-century copy of al-Khuwārizmī's famous treatise on algebra produced in India by the scribe *Mirzā Abū al-Qāsim*. On display is a section of the preface of this work in which al-Khuwārizmī describes how he was encouraged by the Abbasid caliph al-Ma'mun to write a treatise on calculation by algebraic means focusing on what is easiest and most useful in arithmetic as men often need in their dealings with people, land, and goods. He mentions its use for inheritances, endowments, debts, trade, and land mensuration. Many problems throughout rely on knowledge of the Qur'an and Islamic jurisprudence and detail complicated cases for Islamic law of inheritance which has clear rules for estate division.

Līlāvatī is a Sanskrit mathematical treatise on arithmetic written by the Indian mathematician and astronomer Bhāskarācārya (c. 1114–1185). Bhāskarācārya is known for his proof of the Pythagorean theorem, his work on indeterminate equations, and for developing spherical trigonometry and preliminary concepts of calculus. Bhāskarācārya's mathematics was taken up by the Kerala school of mathematics and astronomy, which flourished between the

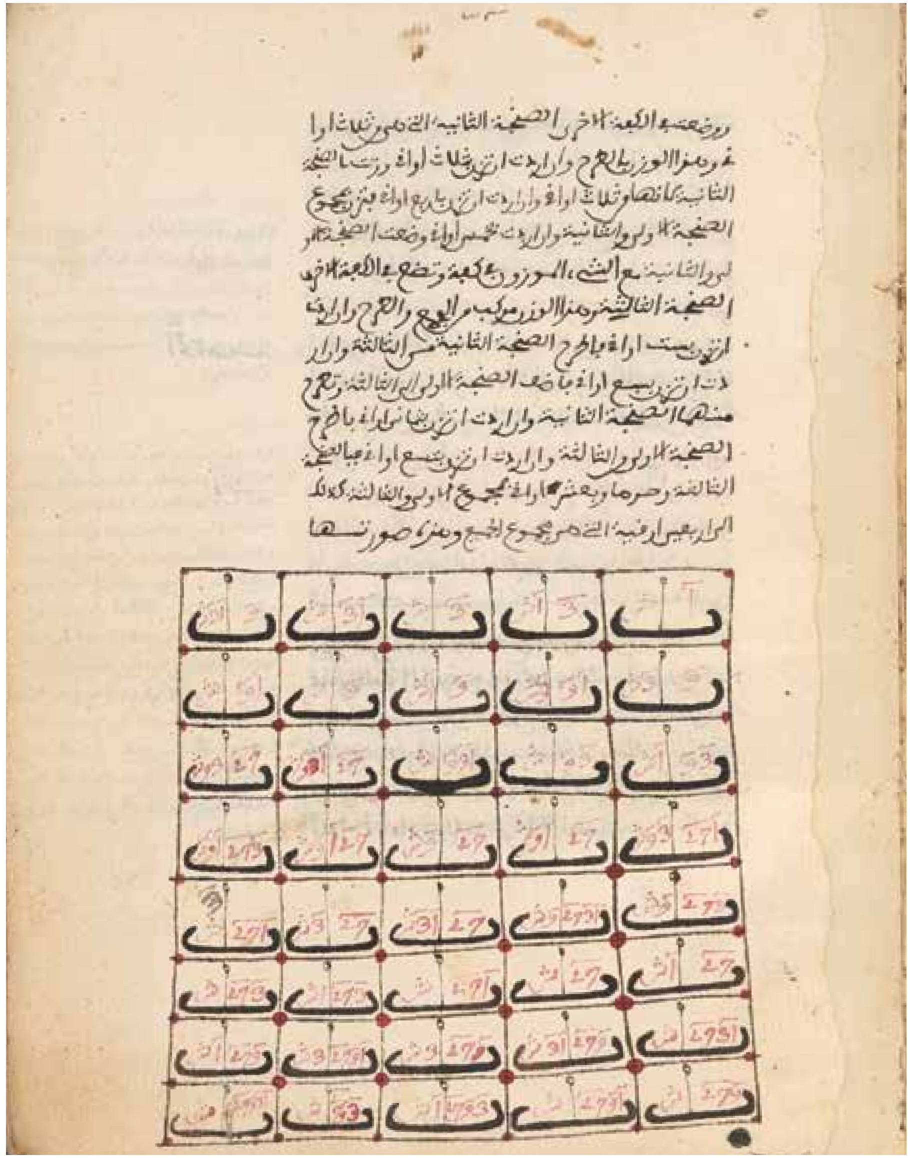


MS Or 54, Bhāskarācārya, 1114-, *Līlāvatī*, [India?], 1675. RBML, Gift of David Eugene Smith, 1931-1934

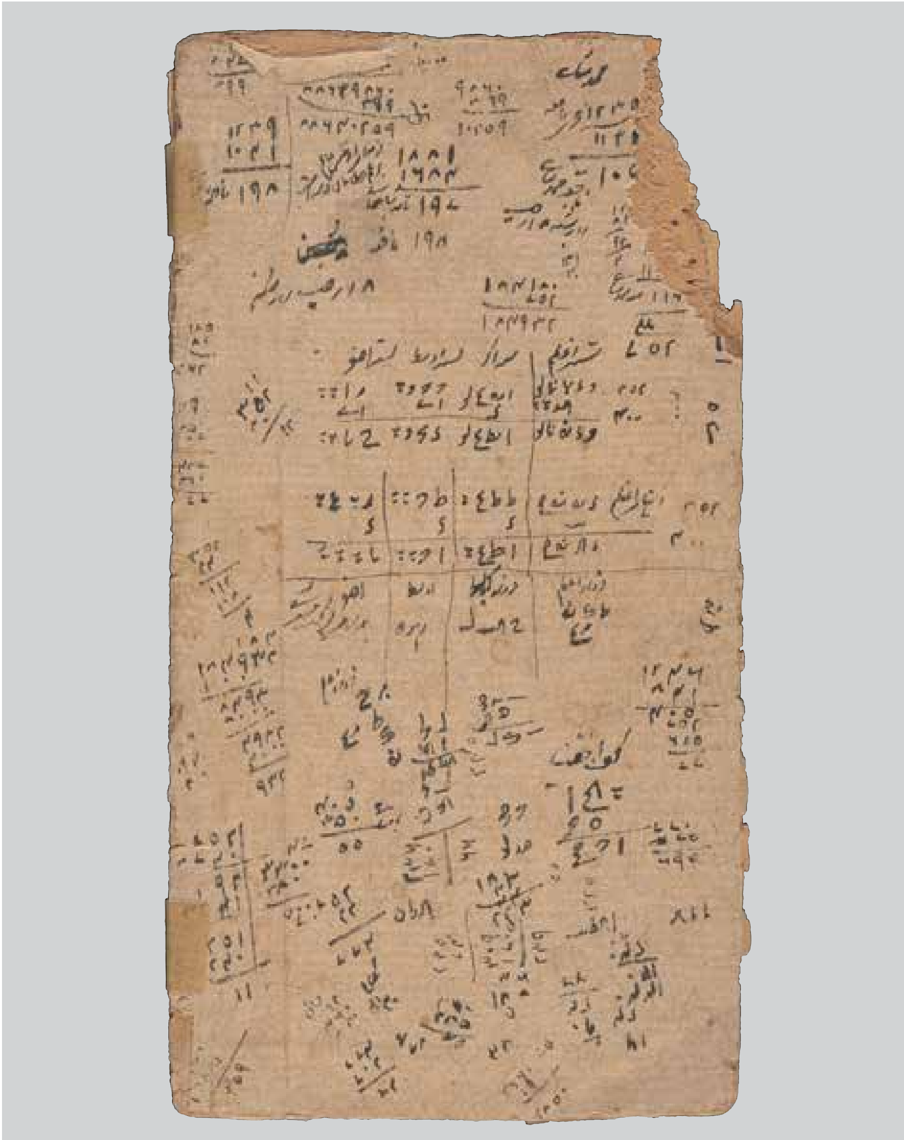
fourteenth and sixteenth centuries in Kerala, India, famous for their contributions to the fields of infinite series and calculus, centuries before similar ideas were developed in Europe.

This manuscript is a Persian translation of Līlāvatī, commissioned by the Mughal emperor Akbar I in 1587, translated by Abū al-Fayḍ ibn Mubārak Fayḍī, and copied in 1675. On display is a diagram showing two of the many different methods of calculation described in this book. In this book, Bhāskarācārya also gives 22/7 as the value of pi and methods for solving indeterminate equations, combination, and series problems. He provides many examples (using kings, pearls, elephants) for calculation exercises and problems for students, sometimes written in verse.

Post-classical North Africa had a lively tradition of mathematics that emphasized pedagogical utility, practicality, and memorization. Aḥmad ibn Muḥammad Ibn al-Bannā’ (1256-1321) was a Moroccan mathematician, astronomer, and Sufi who wrote a popular mathematical treatise *Talkhīṣ a‘māl al-ḥisāb* (or “*The Abridgement of the Operations of Calculation*”). Proving difficult for students, he wrote a commentary in the form of a poem entitled *Lifting of the Veil in the Operations of Calculations*. The Moroccan scholar Ibn Ghāzī al-Miknāsī (1437–1513) wrote poetical commentary on Ibn al-Bannā’s poetical commentary entitled *The Craving of the Calculators*. Ibn Ghāzī then later wrote a further commentary explaining his poetical commentary called *Bughyat al-ṭullāb ‘alá Munyat al-ḥussāb* (“*The Desire of Students for an Explanation of the Calculator’s Craving*”). The copy here shows the original text of *The Craving of the Calculators*, written in red ink, in *rajaz* meter, with Ibn Ghāzī’s further commentary written throughout in dark brown. The section on display shows examples of the gelosia method of multiplication, using the diagonal grids to guide calculation (the lattice method).



MS Or 50, Ibn Ghāzī, Muḥammad ibn Aḥmad, 1437 or 1438-1513, *Bughyat al-ṭullāb fī sharḥ Munyat al-ḥussāb*, [Morocco?], 1747. RBML, Gift of David Eugene Smith, 1931-1934



This short book consists of two works in Persian; the first is on calculating the direction of the Qibla, and the second is on spherical geometry. The second Mughal emperor Humayun (r. 1530-40, 1555-56 CE) is referenced in the title of the first work, implying that it was possibly written at his court. The second work provides a mathematical background to understand the first better. Medieval Muslim mathematicians produced many innovations in spherical trigonometry which had important applications for calculations of the direction of the Qibla, i.e., the direction of daily prayer (a theological, mathematical, and practical problem). As all Muslims are required to pray in the direction of Mecca, scholars debated the distinction between the *jiha* (general direction) and *samt* (exact, calculated direction) of the Qibla, the implications of "errors," and the relative importance of mathematical knowledge in everyday life and Islamic jurisprudence. The back cover of this well-used manuscript is displayed to show calculations performed by a past owner of the work.

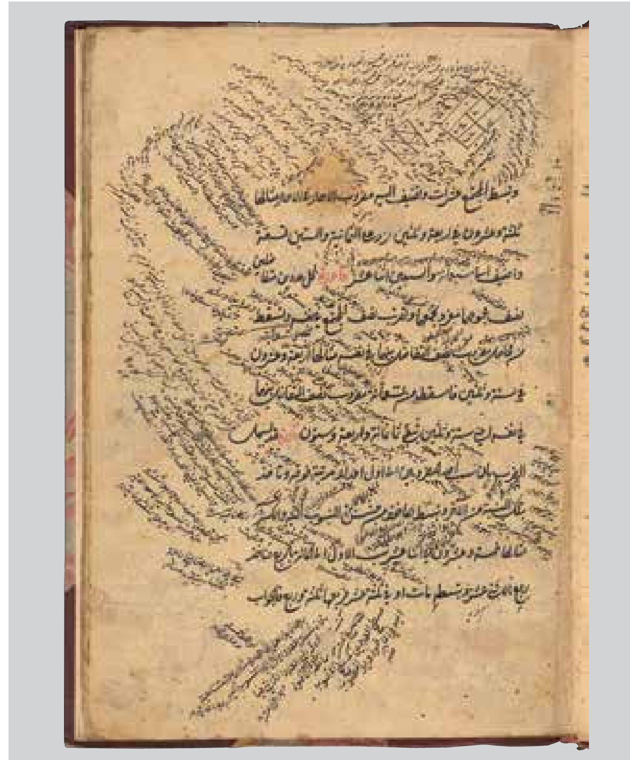
MS Or 46, *Sharḥ-i ʿaṣā-yi mukhtariʿ-i humāyūn pādshāh. Ganj-i nahān khānah-i ḥayy-i qadīm*, Lahore, 1596. RBML, Gift of David Eugene Smith, 1931-1934

MS Or 45 is one of the most interesting manuscripts in our collection for historians of Islamic science for three reasons: first, this is a compilation of fifteen rare works and suggests that the connections between the various sciences (e.g., music, geometry, algebra, etc.) remained very close well into the 14th c. in the Islamic world; second, this majmu'ah (compilation) may have acted as a "mini-library" or a "curriculum" perhaps compiled by the owner for the purpose of his or his family's edification, or probably used at an educational institution for the sake of fulfilling some science requirements; and third, the scribe/original user of the MS collection has recorded his personal notes on each MS here referring to them extensively and discussing their content. This compilation contains many unique, interesting or rare works including: a treatise by the twelfth century Persian scholar al-Muẓaffar ibn Muḥammad al- Ṭūsī [On dividing the area of a square]; the only extant Arabic translation of work by the famous Greek mathematician Aristarchus of Samos, Kitāb aristārkhus fī jirmay al-shams wa al-qamar wa ab'āduhumā, [On the sizes and distances of the Sun and Moon]; to a unique work by Omar Khayyam (1040-1131) on algebra. It also contains works by Ibn al-Haytham, Apollonius and al-Fārābī. This manuscript and its history embody and document the rich history of Islamic science pedagogy in the Islamic world.

MS Or 45, *Fī al-falak wa-al-handasah wa-al-ḥisāb, [compilation, majmuah by several authors]*, !3th/14th Century. RBML, Gift of David Eugene Smith, 1931-1934

MS Or 36, Rajab ʻAlī Beg, *Badīʻ al-ḥisāb*, Lahore, 1851. RBML, Gift of David Eugene Smith, 1931-1934

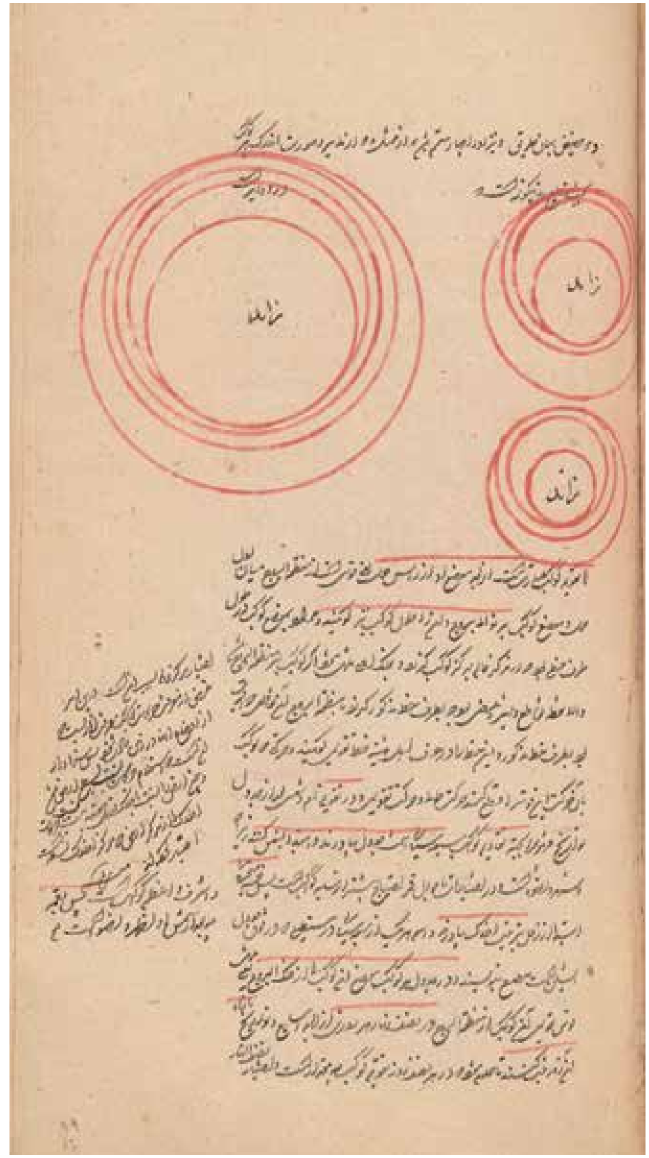
MS Or 36 is a manual of arithmetic and geometry from the 1850s, Lahore, Pakistan that deals with practical applications such as how to calculate the area of a ship. The manual outlines multiple solutions to geometric problems. On display here is a page and diagram of the tool شاقول (shakul). The commentary explains how to calculate the weight of the earth while digging underground water canals. This section deals with the calculations of various volumes. MS Or 36 is an example of the applications of various geometric problems that were employed for practical purposes.



MS Or 33, ʻĀmilī, Bahā' al-Dīn Muḥammad ibn Ḥusayn, 1547-1621, Khulāṣat al-ḥisāb, [Iran?], 16th-18th century. RBML, Gift of David Eugene Smith, 1931-1934

Displayed here is a text by scholar Bahāʾ al-Dīn Muḥammad ibn Ḥusayn al-ʿĀmilī (d. 1621) who was known for his works on astronomy, mathematics, and the religious sciences. This is a display from the Khulāṣat al-ḥisāb, a popular textbook which was studied throughout the Islamic world from Egypt to as far as India. The text highlights the culture of mathematical learning and pedagogy. According to al-ʿĀmilī, mathematics is a science through which one can acquire knowledge about numerical unknowns.

MS OR 51 is an astrological and astronomical text that describes solutions important to the practice of Islam. This is a commentary on Birjandī's *Bīst bāb dar taqvīm*, a short treatise on chronology. This text and commentary includes twenty chapters which include information on calendar systems, the Zodiac, movements of the sun, moon, and stars which deal with calendar systems, tables for prediction, and astrological significance of eclipses. ❖



MS Or 51, Gunābādī, Muẓaffar ibn Muḥammad Qāsim, -1621 or 1622, sharḥ-i bīst bāb, [Iran?], 1786. RBML, Gift of David Eugene Smith, 1931-1934

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Occult Sciences

The term “occult sciences” refers to varying, yet inter-connected intellectual and practical endeavors related to divination and magic. Building on popular intellectual traditions in the ancient world, the occult sciences flourished further in the Muslim world and remained a ubiquitous presence for many centuries. Arabic, Persian, and Turkish terms such as *ʿulūm gharība* (uncommon or strange sciences) or *ʿulūm khafiyya* (hidden or secret sciences) were frequently used to refer to a broad range of practices, including astrology, celestial magic, alchemy, dream interpretation, and lettrism (the science of letters, *ʿilm al-ḥurūf*).

Across their variety, the occult sciences are primarily intended to address inexplicable phenomena, connections, qualities and forces of celestial and terrestrial objects, which are considered to exert an influence on the manifest world or to be portents or omens of forthcoming events. Adepts at different occult practices are believed to grasp what these hidden qualities are, and to be able to predict the influence of these unobservable or “hidden” forces and objects on manifest reality. Far from being “marginal” or “rogue” sciences, most occult sciences consistently figured as a category in many of the major Arabic, Persian, and Turkish works on the classifications of the sciences. For example, Ibn Sīnā (d. 1037), in his famous compendium “al-Risāla fī aqsām al-ʿulūm al-ʿaqliyya” (A treatise on the Classification of the rational Sciences) clearly classified the occult sciences as belonging to the “natural” or “mathematical” sciences (Ibn Sīnā, “al-Risāla fī aqsām al-ʿulūm al-ʿaqliyya,” 108–111.)

These sciences, and the questions they pose clearly bring into relief several key features of scientific endeavors within the Islamic scientific traditions: the rejection of an anthropomorphic world; the belief in an inter-related, dynamic world; a deep sense of humans being just one small element of the universe, subject to other forces; and a vibrant sense of curiosity and awe.

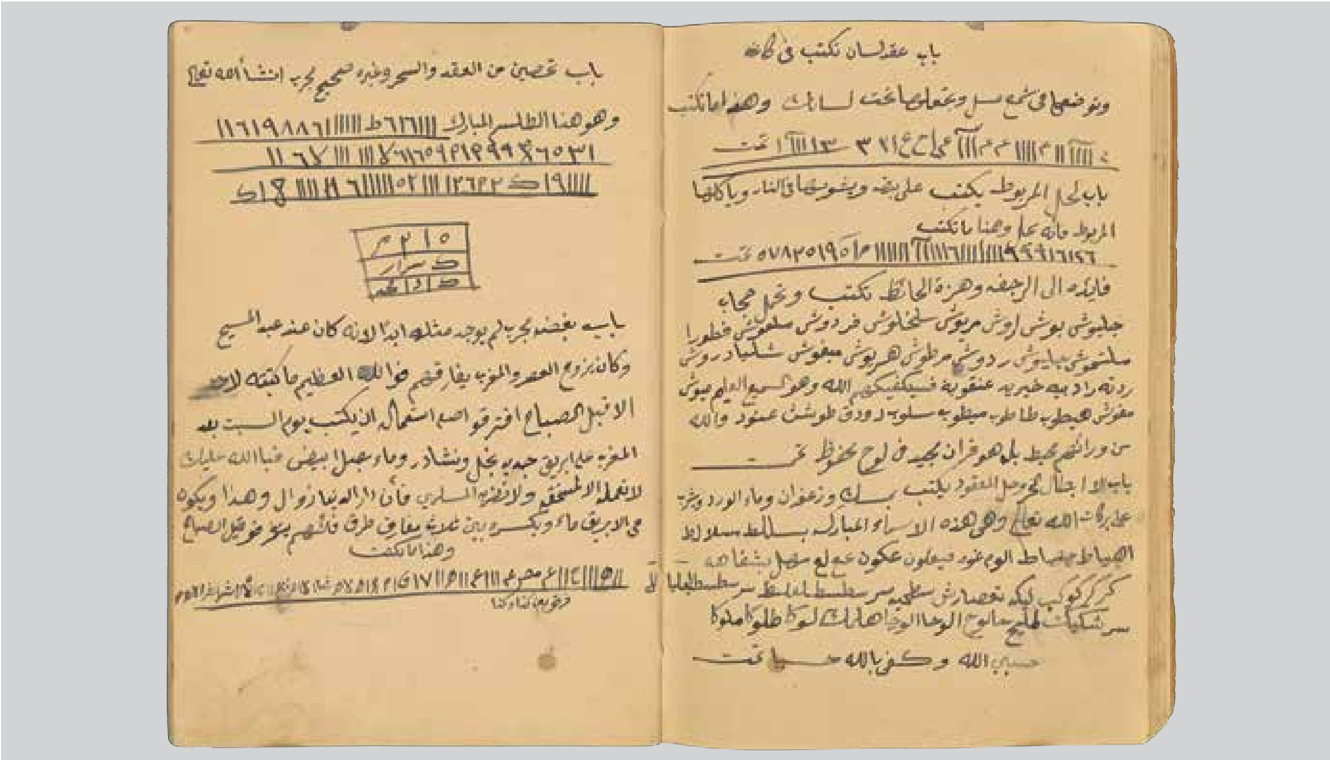
While the term “occult” implies “hidden” or “exclusive” knowledge, namely ascription to a specific group, the wide textual dissemination of different occult scientific knowledge in the Muslim world shows that exclusivity and secrecy were not always a significant concern. That the occult sciences permeated different constituents of Muslim society and overall enjoyed a wide recognition does not mean that mainstream Muslim scholars and thinkers universally approved of them. Some of the well-known figures of Muslim intellectual life, such as Ibn Sina, al-Ghazali (d. 1111), Ibn Taymiyya (d. 1328), and Ibn Khaldun (d. 1406), composed critical works refuting some aspects of certain occult practices (specifically, astrology, alchemy, and magic), on legal, theological, and philosophical grounds. Despite these widespread critical standpoints, occult sciences remained a vibrant element of Muslim intellectual practice well into modern times.

The Muslim traditions of occult sciences in the Islamic world were rooted in several sources and traditions, including interpretations of elements of the Qur’an, linguistic and rhetoric elements of the Arabic alphabet (*ʿilm al-ḥurūf*, the science of letters) as well as the pre-Islamic knowledge practices of Greek, Indian, Persian, Babylonian, or Syriac heritage. During the Abbasid translation movement from the eighth through the tenth centuries, numerous works on astrology, alchemy, dream interpretation, physiognomy, and related disciplines were translated into Arabic from the original Greek, Persian, or Syriac. Muslim authors soon started composing new works in different languages on various occult sciences, synthesizing pre-Islamic materials and adding new theoretical and practical dimensions. Perhaps the most distinctive Islamic occult science is the science of letters and names (*ʿilm al-ḥurūf wa’l-asmāʾ*), which posits the letters of the Arabic alphabet and the names of God found in the Qur’an as the constitutive elements of the universe. These letters, names, and symbols are frequently used in texts and talismans to provide protection, influence the present and future, and overall reshape manifest reality.

The study of the occult defies many divisions that we have currently inherited in our post Enlightenment world, namely divisions and dualisms between the divine and the natural, facts and values, the subjective and the objective, the visible and invisible, as well as the definitions and boundaries of "science" and "pseudo-science", the "known" and unknown. As we revisit some of the occult science works on display here, it should be noted that reductive and anachronistic claims need to be avoided, and that notions of "intelligibility" and "rationality" are historically contingent analytical categories. The Islamic sciences of the occult, like the practice of occult sciences in other temporal, cultural and spatial contexts, were the result of a deeply embedded belief in the knowability of the (dynamic) universe and the forces within it. This curiosity and interest in uncovering deep, invisible, strange, unusual, and unknown connections and forces, led directly to the emergence of a vibrant discourse and to "systematic studies of occult forces and explorations on how they manifest in the practice of magic and astrology (action at a distance), divination (intuition), and alchemy (chemical reactions)". (*Islamicate Occult Sciences in Theory and Practice, Handbook of Oriental Studies. Section 1 The Near and Middle East, Volume: 140 Volume Editors: Liana Saif, Francesca Leoni, Matthew Melvin-Koushki, and Farouk Yahya, p. 5*).

Many occult practices, both in their learned and lay forms, draw on the assumption of correspondences between celestial and terrestrial things. The letters in different alphabets, characteristics attributed to planets, metals, minerals, or body parts are viewed as interrelated phenomena, exerting influence on one another. The more learned type of treatises lay out the fuller extent of these correspondences. The more practice-oriented textual fragments and leaflets are slanted toward providing specific prescriptions for achieving particular results. The eight folios in this codex that have no particular beginning and end constitute an amalgamation of lay knowledge on the names of planets, letters in different alphabet systems, and prayers. The instructions inserted around the eccentric human body drawing say: *emboss it on a Saturday, in the (auspicious) hour of Saturn, put it in fire and frankincense, then recite the names written in the middle of the picture*.

MS Or 152a, [*Incomplete Text on Letter Magic*], The text begins and ends abruptly, and consists of eight folios, c. 1700. RBML, Presumed to be a gift of David Eugene Smith, 1931-1934



MS Or 16, *On Charms and Talismans*, (On charms, talismans, supernatural protective abilities of different prayers, inscriptions, and/or Qur'ānic verses. The copy is written in several different hands and has a number of blank leaves in the middle). Author and date of copying unknown, ca. 1813. RBML, Presumed to be a gift of David Eugene Smith, 1931-1934

This manual contains specific magical instructions and formulations one may recourse to for achieving desired results that pertain to everyday concerns and daily relationships of individuals from all walks of life. Divided into loosely separated individual chapters, the manual offers detailed prescriptions regarding what to recite or inscribe for the matter at stake. Sometimes the desire mentioned in the prescribed formula is to bind someone's mouth shut. At another time, it is to ensure immunization from others' "magical knots." As one of the anonymous copyists or compilers of these folio notes, the given instructions and the recommended auspicious talismans are all "tested" and "experienced" (*mujarrab*), hence ascertaining their truth value based on experiential evidence in the eyes of their audience. Altogether, these formulas and instructions reveal to us daily practical and affective concerns of ordinary individuals: they provide mirrors onto a lived subjective and affective reality, and into a deep belief in an inter-connected, "animated" and "enchanted" world.

MS Or 276, *Dhakhīrat al-Iskandar al-Malik ibn Fīliqos Dhī al-Qarnayn*, 1700-1847; Treatise in 10 chapters on talismans and celestial magic attributed to Aristotle (who allegedly wrote it for Alexander) and was translated into Arabic at the request of the Caliph al-Muʿtaṣim billāh (r. 833-842). RBML, Gift of David Eugene Smith, 1931-1934

The Abbasid translation movement from the eighth to the tenth century brought numerous texts of ancient sciences, antediluvian wisdom, and Greek tradition into Arabic. The treatise at stake here is a late copy of one such text on the uses of poisons, alchemical charms, celestial magic, and talismans. The book was originally written, as the text says, for Alexander the Great, also named in the Quran and in several medieval Islamic sources as "Alexander Dhu'l-Qarnayn" ("Alexander the two-horned"). Allegedly found in a monastery after one of the military conquests of the Abbasid caliph al-Muʿtaṣim billāh, the text was translated into Arabic at the caliph's request. The prescriptive nature of the book and the detailed instructions provided in each chapter for preparing charms and talismans (e.g., how much of a material should be used and at what specific time) not only illuminate the theoretical backbone of the practice but also document its heavy reliance on material culture for transmission practices.

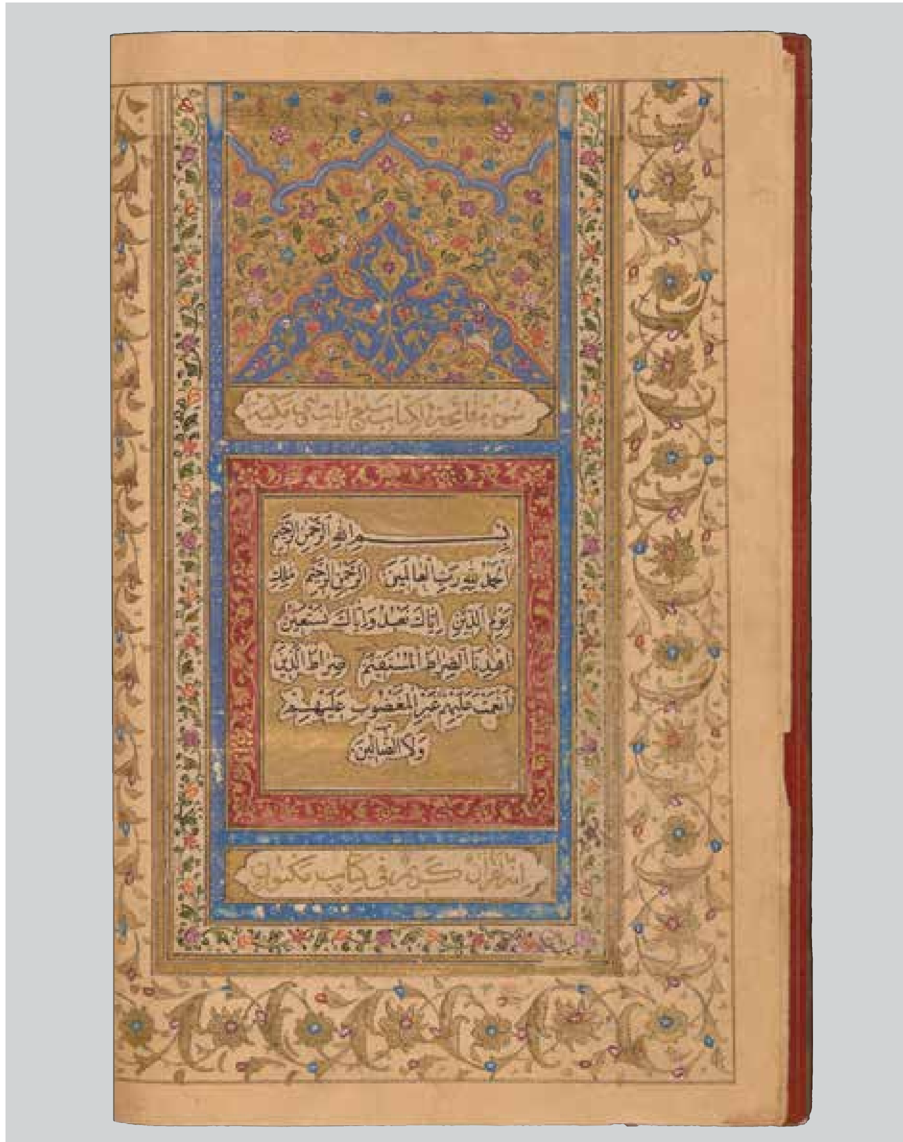
The divinatory art of geomancy (*ʿilm al-raml*, lit. science of sand or divination by earth) is a widespread practice of fortune-telling performed by forming and then interpreting a design, called a geomantic tableau. The design consists of 16 positions, each occupied by four lines of a geomantic figure. In its original form, the geomantic figure was created by making lines of dots in the sand, but medieval Muslim practitioners often drew the dots on a piece of paper. Each geomantic figure represents a separate meaning for the seeker of fortune in any aspect of human experience, from marriage and health to career prospects. Drawing on associations with four elements, seven planets, and their characteristics, the art of geomancy owes a great deal to astrology. Unlike astrology, geomancy requires no instruments or complex astronomical calculations. In geomantic lore, Surkhāb, the author of this popular Persian treatise, was the name of the shepherd who became prophet Daniel's first client. A strong indication of the work's popularity is that it was quoted by the famous Timurid polymath Ḥusayn Vāʿiẓ-i Kāshifī's (d. 1505) renowned magic manual. It survives in over 25 manuscript copies in Iran alone, and a lithograph was printed thrice.

MS Or 39, Surkhāb, *Kitāb-i Surkhāb dar ʿilm-i raml*, 1528. RBML, Gift of David Eugene Smith, 1931-1934

MS Or 65, Tustarī, Ṣūfī Kamāl, active 14th century, [Ghāyat al-murād fī wafq al-a'dād], Shīrāz; (Treatise on magic squares, copied in Shiraz at the end of Dhul-qadah in the year 866 A.H.)—August 1462. RBML, Gift of David Eugene Smith, 1931-1934

The science of magic squares, or more literally, the harmonious disposition of numbers (*wafq al-aʿdād*), draws on an arrangement of a set of numbers. These numbers are arrayed, mostly but not exclusively, in a square grid so that the sums of the numbers contained in each column, row, and corner-to-corner diagonals give the exact same number. Found either as individual scrolls and sheets of paper or inscribed in separate folios in manuscripts, these squares are considered to function as talismans in their own right. The occult forces or properties were derived from the numbers they included, the letters of divine names numerically encoded in the squares, and the correspondences of these letters in the realm of spirits, planets, and elements. Divided into forty chapters and annotated with extensive marginalia by subsequent generations of readers, Tustarī's fourteenth-century treatise in Persian presents a rich theoretical and practical grasp of the science of magic squares prevalent especially in the late medieval and early modern Persianate world.

Bibliomancy is the art of turning to a book, typically a sacred text, by an augury-seeker searching for practical guidance and a proper path of action. Books are opened on a random page; the words and passages augury-seeker encounters on the opened page are then interpreted, either by an expert practitioner of bibliomancy or the augury-seeker themselves, as a good or bad omen. The practice of bibliomancy based on scripture is evidenced across different religious traditions, from early Judaic exegetical exercises to medieval Christian and Buddhist traditions. In Islamic forms of bibliomancy, some other renowned and esteemed texts of literary nature, such as the Persian poet Ḥāfıẓ's Dīvān or Rūmī's Mathnawī, were also used besides the Qur'ān. Certain Qurʿān copies include, often at the end of the volume, specific instructions on how to perform bibliomancy.



MS Or 91, al-Qur'ān, [Iran?], 1776.
RBML, Gift of David Eugene Smith, 1931-1934

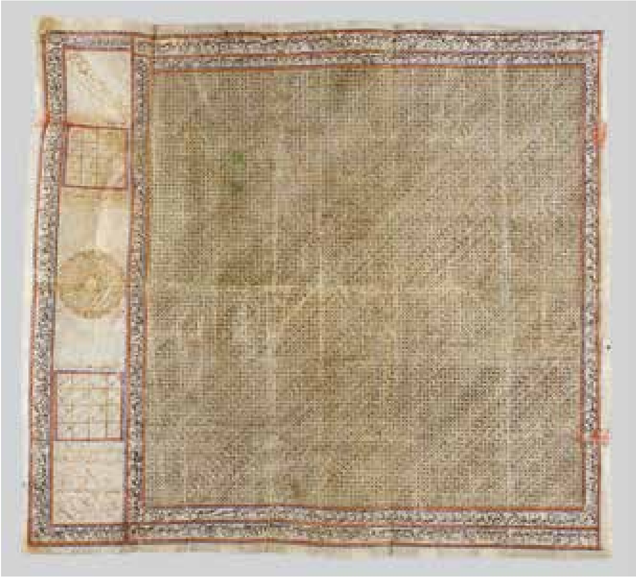
MS Or 504, *Scroll with Holder Ḥirz Chahārdeh Ma'ṣūmīn, undated, Persia, Twelver Talismanic scrolls worn as amulet, used to ward off evil and misfortune through the intercession of the fourteen 'infallibles.'*

MS or 506, Scroll Contains a supplication known as u'ā 'Umm al-Ṣubyān, A supplication, attributed to Soloman, which is rolled up and worn as an amulet by pregnant mothers and young children in order to ward off the Umm al-Ṣubyān demon.

Talismanic objects are an essential component of Islamic material culture. Coming in various shapes and forms, from tiny amulets (*ḥamā'il*) and scrolls fastened to the arm or turban, or hung over an archway or a door, to magic-medicinal bowls, water bowls incribed with Quranic verses to appease fear or ward the evil eye, and talismanic shirts and charts, these objects were and still are in wide use in the Muslim world. The inscriptions in these objects may include specific Quranic verses, supplications to God and spiritual forces, or special symbols, alphabets, and numerological correspondences. All these inscriptions endow the object with the presumed talismanic efficacy toward protecting one's life and property against potential damages or achieving one's long-held desires. Here is a sample of talismanic scrolls that were prepared in different eras in diverse religio-social circles, Sunni and Shiite alike. For instance, the one with a number of *ḥirz* (literally, fortified place or refuge) was more common in the Shiite culture, with the names of *Imams* separately inscribed with the prescribed prayers. The scrolls were sometimes preserved in nicely decorated amulet cases that often contained similar inscriptions and were worn as adornments and jewelry, or hung in corners, or over doorways and arches.

MS Or 326, [Protective Talisman] /[Protective Talisman], 1 unfoliated leaf, Parchment, 480 x 430 mmArabic, Script: Naskh, Layout: Numerical table with verses of Qur'an written on the sides, Presumed to be a gift of David Eugene Smith, 1931-1934 (Personal Image)

This precious protective talismanic object, written in gold on a translucent parchment measures 480 x 430 mm. Intricate numerical tables (i.e., magic squares) and special magical symbols named the Seven Seals can be seen in the center and on the corner. They are surrounded by several "protective" surahs and verses of the Quran, including the entirety of *Surah al-Ikhlas* ("Sincerity"), *Surah an-Nas* ("Humankind"), and verses from the *Surah an-Nur* ("Light"), al-Falaq, ("Daybreak") usually known as "al ma'udhat", the protective verses. This work is extremely fragile, and required extensive treatment before being shown here. Parchment is very sensitive to temperature, humidity and light, and cannot be displayed for long. It has been mounted in a special climate controlled box here. ❖



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Beyond Illustration: Adab and Ways of Seeing

God has inscribed beauty upon all things—Hadith
God is beautiful, and He loves beauty—Hadith
Neither heaven, nor angel can fathom,
That which, coming from Him, is at the bottom of the hearts,
Joy or grief–what matters to the sage?
O cupbearer, give (us) some wine of joy, for the sorrow is from Him

سعدی شیرازی, Saʿdī Shīrāzī (born 1210; d,1291 or 1292)

Islamic theology assigns great weight to the idea that God and His Creations instantiate beauty, and that love of beauty is one of the paths that lead to God. According to Islamic belief, while we cannot see God, we do see His *āyāts*, His creations, and by appreciating them we engage in pious activity, cultivating the soul and working to fulfill its potential to emulate the divine within and without. *Khayāl*, which is the human faculty of imagination, is the power which makes such an achievement possible: it is what allows us to appreciate beauty and "see beyond" by weaving together perception, reason and imagination, and thereby it takes us to a realm of thoughts, feelings and perceptions beyond the immediate. Aesthetics and ethics overlap and align: Islamic arts, in all their complexity and variety, seek to make the beauty of God and His nature present and tangible to us.

While figural representation is forbidden in religious contexts (e.g., the decoration of mosques, holy shrines and tombs, and Qur'anic schools), it is widely embraced elsewhere, not only in royal and quotidian spheres, but in particular, in the art of the book, celebrated cross the Islamic worlds. There, text and image enter into a rich dialogue, and a liminal space is created, a portal opening onto a reality "beyond" the visible and immediate, ushering in spiritual, aesthetic and ethical growth. The power of *khayāl* enables the spectator to engage with the work's complex relations to artistic media, styles, forms, and practices, and thereby to appreciate visions and perspectives beyond the mere here and now, as the work induces resonances within her and on the page.

Works of illustration thus engage the spectator in literary, visual, affective, aesthetic, and ethical acts of appreciation and self-edification crucial for the cultivation of "adab" (taste and refinement more generally). Adab involves the proper alignment of the various elements of the self in relation to one another and to the environment, and it shows itself as the sensitivity needed to appreciate and judge and as the display of contextually appropriate gestures, expressions, and emotions.

In this tradition, art, craft, and science coalesce to render exquisite objects possible: the sciences of mathematics, geometry, music, and cosmology are all interconnected (an idea not so different from the medieval Christian notion of *ars sine scientia nihil est*). The implication with regard to manuscript production is that serious scientific endeavor is what accounts for the elaborate page layouts on display, with their subtle and overt effects. Workshops devoted to bookmaking were set up across the Islamic worlds, and highly sophisticated techniques were developed for e.g., inking, dying, paper furbishing, page layout (*misṭara* lining of pages), ornamentation, illumination, and illustration.

Noteworthy examples of the book arts on display here include: manuscripts devoted to the epic poem *Shahnameh* (Book of Kings), which was first gathered and written down around the year 1000 CE by the famous Persian poet, Firdawsī (940-1020). It consists of a huge collection of heroic deeds and dramatic moments from pre-Islamic times up to the Arab conquest in the seventh century CE. Here we see many famous figures and mythical creatures depicted, e.g., Alexander the Great, Bahram Gur, Rustam and Sohrab, winged dragons, and the powerful bird *simurgh*. Also on view is a *Khamsah* (Quintet) of Niẓāmī Ganjavī (1141-1203) in a lavishly illustrated manuscript. It tells stories of love and devotion--such as those of Khusraw and Shīrīn;

Layla and Majnūn—that were copied and illustrated by a variety of patrons, and have been continuously published over the centuries in different editions, each of which revealing a specific anachronistic gaze through which the past has been understood, creating resonances and affective connections across many generations. For example, the story of Queen Nushaba showing Alexander his portrait resonates with us today, insofar as gender, power and class relations play a central role. Equally, the chaos and cacophony of destruction which is displayed in the image of the battle of manuscript MS X892.8 M31 resonate with us, as do the subdued colors of the pastiche of the son of King Sohrab taken prisoner by his own father, with jealousy, suspicion and greed destroying filial and parental bonds. The clear tensions on display in the red lacquered painting of the journey of the ṣūfī, e.g., those between youth and wisdom, vitality and old age, are also remarkable in their subtle engagement with the relations between the here-and-now and the larger arc of the individual life.

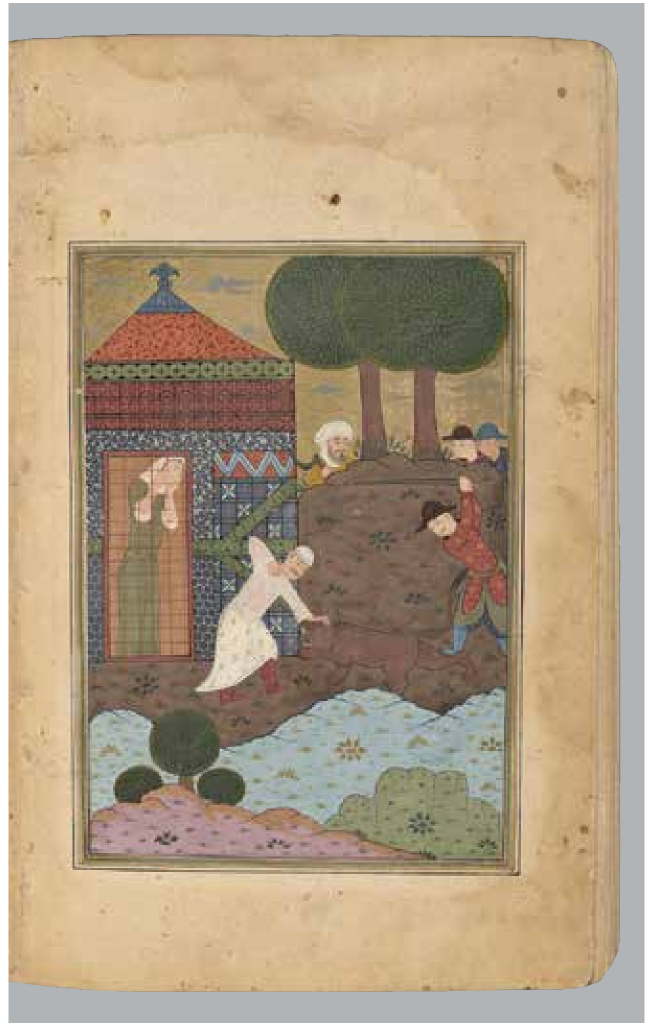
This mid-19th to mid-20th c. simple watercolor, most likely from Iran, depicts a wandering dervish, in a pink, flowing tunic garb against the backdrop of a green, hilly background, and a blue sky. Drawn first with pencil (marks can be seen in the margins) and then painted over with opaque colors on paper, a bald man is depicted standing, one foot at an angle, as if in motion, wearing sandals, a green cloak, and a rope belt with two objects hanging from it, holding a staff. The staff powerfully protrudes into the frame of the illustration, opening up a hyper-mimetic liminal space, suggestive of a porous barrier that opens up possibilities.

The simplicity of the drawing style, the unprepossessing features, his shaven head, large teeth, and the simple garb which stands in contrast to the embellished jewelry—including earrings, a belt, anklets, and an

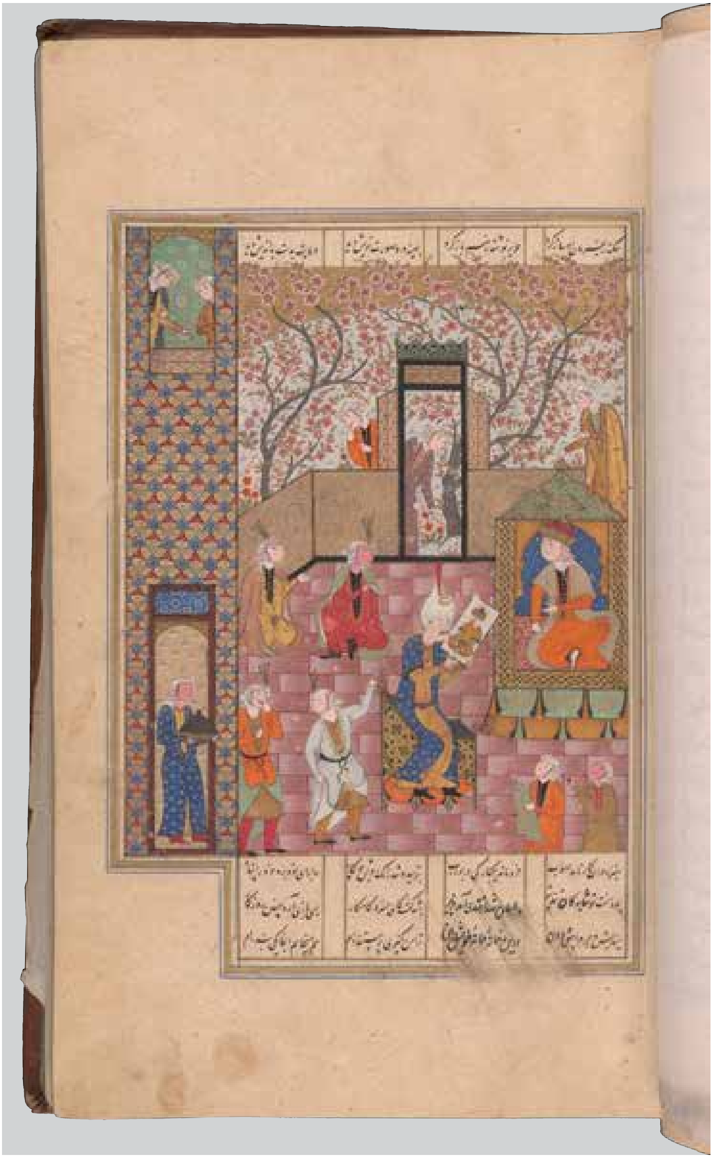
Ms Or 152b, [Wandering Dervish], [Iran?], [between 1850 and 1950?]. RBML, Presumed to be a gift of David Eugene Smith, 1931-1934 archer's thumb ring—render this an iconic depiction of the spiritual richness and nobility of the wandering life led by dervishes. While his opaque water-color pink and green garb is flowing and wrinkled to suggest there is abundant cloth, his footwear suggests a homely simplicity and a rootedness in motion, travel and exile and his smile seems to evoke a spiritual sense of contentment: with these simple narrative painterly tricks, the wandering qalandar pulls the viewer in, suggesting an invitation to join the sufi on his journey.

This scene from a sixteenth-century copy of the Khamsah (quintet) of Amīr Khusraw Dihlavī (ca. (ca. 1253-1325) depicts the heroic king Khusraw killing a lion outside the tent of his beloved, Shīrīn. Though the king Khusraw II (r. 590-628) and queen Shīrīn (d. 628) were historical figures in pre-Islamic Sasanian Iran, their story was fictionalized in Persian literature, and versions appear in the Shahnamah (Book of Kings), Khamsah of Niẓāmī, Khamsah of Amīr Khusraw Dihlavī, and numerous other works. From the medieval period onward, scenes from their courtship have been one of the most popular subjects of Persian art.

This exceptional folio features a highly stylized landscape depicted in rich jewel tones. The foreground is occupied by hills in striking shades of aquamarine, mauve, and sage; the ground is patterned with abstracted vegetation, while artificially round trees punctuate the terrain. At the center of the page, Khusraw bravely takes on the beast with his bare hands, while Shīrīn watches in distress from her lavish tent, which is hung with fine textiles in abstract and vegetal motifs. The Grid-cage like on the door of the tent, is a stark reminder of Shīrīn's vulnerable state. A figure at right brandishes a sword at the lion, while onlookers peer over a hilltop at the spectacle, resonating with our own state as viewers of this scene, too. The diagonal line stretching from the viewers at the top right, to the center of the page, which is well defined by Khusraw's forward leaning body, shrouded in stark white in the midst of the muted palette, places our gaze in dialogue with the viewers within the page, and we become at once insiders and onlookers.



Ms or 368, [Būstān and Gulistān], Būstān with a marginal copy of the Gulistān/ Sa'dī, [Iran?], [16--?—17--?], Iran, Khusrau Kills a Lion Outside Shirin's Tent, Folio from a Khamsa (Quintet) of Amir Khusrau Dihlavi (976-978 AH/1568-1571 CE), Ink and opaque watercolor on paper (?). RBML



This illumination comes from a lushly illustrated 17th c. manuscript of the Khamsah of Niẓāmī, namely from the Iskandarnāmah, Niẓāmī's epic retelling of the life and deeds of Alexander the Great. Though Alexander is a historical figure, most of the tales from the Iskandarnāmah derive from legends about the ruler first written in Greek, which entered Persian oral tradition during the Sasanian period and went on to become some of the best known stories in the Persian speaking world.

In this scene from the Iskandarnāmah, Alexander disguises himself as an envoy sent to the court of Queen Nushaba. Recognizing the ruler from his portrait, Queen Nushaba confronts Alexander with his likeness, while members of her court look on. Alexander and Queen Nushaba are noticeably larger than other figures in the scene, indicating their relative importance. This exceptionally fine illumination of the scene combines precise geometric motifs with a flattened perspective that allows the viewer to see the scene from multiple viewpoints–both characteristics that are typical of Persian manuscript paintings in this period. At the same time, the figures are rendered in elegant and naturalistic poses, and the blossoming trees seen in the courtyard beyond the palace walls display the artist's virtuosic skill.

MS X892.8 N651 Folio, Niẓāmī Ganjavī, 1140 or 1141-1202 or 1203, Khamsah, [Iran?], [16–?]. RBML, Purchased for Columbia with funds donated by John Dyneley Prince, James Speyer and Jacob H. Schiff, Queen Nushaba Confronts Alexander with His Portrait, Folio from a Khamsah of Niẓāmī, 17th century, Iran, Ink, watercolor, and gold on paper

X892.8 Sa12, Saʿdī (1210-1291), [Gulistān]/Complete copy of the text, though with an abbreviated conclusion. Includes marginal numerical notations of the chapters and sections. The paintings are original, not executed over existing text, [Iran?], [18–?]. RBML, Formerly owned by Carl Reinhardt; purchased from his estate

Saʿdī's famous Gulistān falls within the genre of "*adab al-ḥikāyāt*", social adab, a genre which primary function is to edify, and cultivate virtue in individuals (akhlāq, ethics, morality) and with an abbreviated conclusion. Includes marginal numerical notations of the chapters and sections. The paintings are original, not executed over existing text, proper social conduct, taste and judgment (adab). The Gulistān was written within the context of traumatic events, namely the Mongol invasion of Persia. The Gulistān's prologue starts with Sa'dī beseeching God to protect Shiraz from the ravages of the Mongol invasion, and is to be read with these traumatic contextual realities in mind: what was it like to read Saʿdī's Gulistān when the world as the Persians knew it then, was supposed to come to an end? On display here is an interesting painting executed in a typical Qajar style, with a deep and rich palette, which evokes many European brushes and pigments. The second drawing is unfinished, and not painted. It suggests that the drawing was executed separately, then painted over by a different person or at a later time. The painting is an illustration for the first chapter of the Gulistān.

The first few lines of the first chapter "On the Manners of Kings'' read as follows: "I have heard of a king who made a sign to put a captive to death. The hapless one, in a state of despair, began in the dialect he spoke to abuse the monarch, and use opprobrious language; as they say, “Every one, who washes his hands of life, utters all he has in his heart.” He that despairs, gives license to his tongue, As cats by dogs o’erpressed rush madly on. The hand, when flight remains not, in despair will grasp the point of the sharp scymitar. The King asked, “What does he say?” One of the wazirs, who was of a good disposition said, “O my Lord! He says that [Paradise, whose breadth equalleth the heavens and the earth, is prepared for the godly], who bridle their anger, and jorgive men; for God loveth the beneficent.” The King had compassion upon him, and gave up the intention of [spilling] his blood. Another wazir, who was his rival, said, “It seems not such as we are to speak aught but truth in the august presence of kings. This person reviled the king, and spoke unbecomingly.” At this speech the King frowned and said, “That untruth of his is more acceptable to me than this truth which thou hast spoken; for that inclined towards a good purpose, and this to malevolence; and the sages have said, ‘Well-intentioned falsehood is better than mischief-exciting truth.’” [Translation by: Edward B. Eastwick] Reference: Mana Kia, Adab as ethics: **https://mesaas.columbia.edu/wp-content/uploads/sites/68/2018/09/Kia-**

MS Or 152c, [Single leaf with illustration], [Iran?], [between 1850 and 1950?]. RBML, Presumed to be a gift of David Eugene Smith, 1931-1934

This folio represents a scene from the *Shahnameh* or *Book of Kings*, an epic poem that recounts the history of pre-Islamic Persia in 62 stories and around 50,000 couplets. Relying on longstanding existing oral traditions, the poet Firdawsī (often compared to Homer in terms of stature and impact in the Muslim world) took some thirty years (977-1010 CE) to compose the *Shahnameh* in verse under the patronage of the Samanid dynasty. The Shahnameh is considered a seminal work for Persian literature, language and culture, which had broad and deep influence on long standing literary traditions of storytelling across many languages and cultures (Persian, Turkic, Georgian, Kurdish, Pashto, Ottoman and Arab)..

The text contains six lines of text in four columns written in pointed nastaʿlīq, and is interrupted by a pastiche, which refers back to an episode in the Shahnameh about the reign of King Goshtasp. King Goshtasp had become jealous and suspicious of the success of his son Isfandiyar who had excelled with his army, and helped the king conquer new lands. At the insinuation of Gurzam, a warrior who befriended the king and had a secret enmity to Isfandiyar, the king became suspicious of his own son, called him back home from his expedition, and imprisoned Isfandiyar along with his companions, in a prison tower inside the palace on a nearby mountain.

The painting, in gold and opaque watercolors, depicts six figures, four on the right side in helmets and chains and two on the left, including a figure seated upon a throne whose face is now obscured. Details of the faces have faded with a few exceptions where the eyes and the arch of the eyebrows can still be seen. The prisoners wear luscious, ample robes with intricate golden rims, and have helmets on their heads indicating their high social rank. One person is wearing a red robe with a vibrant color, which stands out in sharp contrast to the dark bluish deep background. Another figure (possibly Isfandiyar?) wears an intricately decorated helmet, with a crownlike border. The lines of the text are border-ruled in red and black. The text above the illustration reads as follows:

ولیکن تو شاهی و فرمان تراست تراام من و بند و زندان
تراست کنون بند فرما و گر
خواه کش مرا دل درستست و آهسته هش

You are the king and the ruler; I am yours and you can imprison or kill me if you want; my heart is just and beating slowly (i.e., I am innocent and not afraid).

The verso holds two clippings of unrelated text pasted in different directions. One identifiable text starts with Iskandar's story:

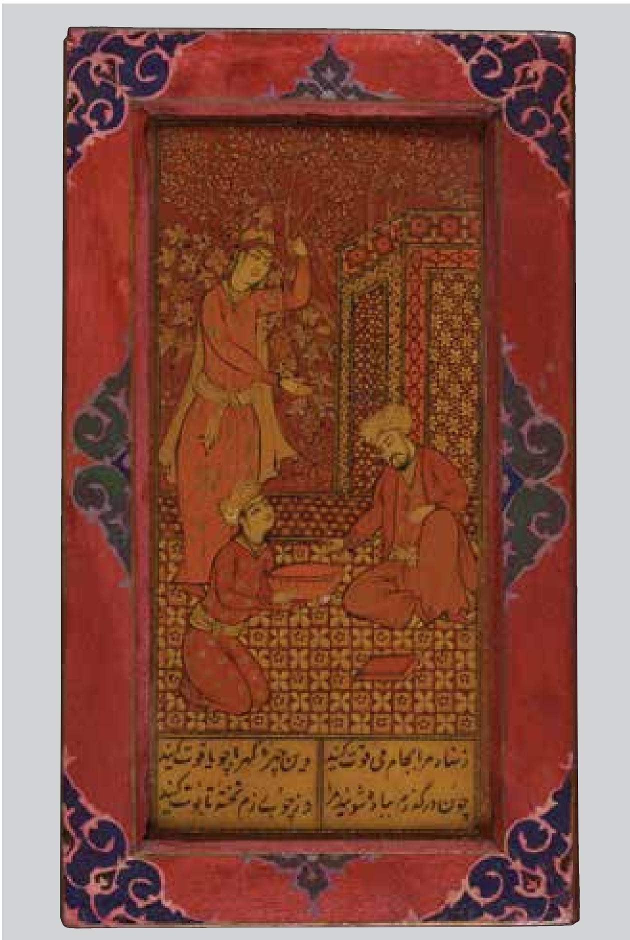
چو آمد سکندر به اسکندری جهان را دگرگونه شد داوری
—when Alexander came to Alexandria, the world was changed.

This dynamic battle scene, dating from the mid-seventeenth to mid-eighteenth century, once belonged to a now unknown manuscript, and was later compiled into this nineteenth-century Persian album.

Albums like this one combine pages from a variety of sources, time periods, and artists, including single page paintings, examples of calligraphy, and illuminations from dispersed manuscripts.

The chaos of warfare is echoed by the dense composition of this illustration, where the bodies of warriors and horses overlap. The visual impact of the figures' colorful clothing and gold armor at first belies the horror of the scene. A dismembered figure in the composition's lower right segment reminds viewers of the grave stakes of battle, while the figures on horseback are depicted in mo-

MS X892.8 M31, [Persian calligraphy and illustration album], [Iran?], 1650-1750?, "The sounds of battle, Folio from an unknown manuscript", Iran, Ink, watercolor, and gold on paper. RBML, Purchased for Columbia with funds donated by J. Dyneley Prince, James Speyer and Jacob H. Schiff ments of pivotal tension: the figure in the upper right slumps forward as he is hit with a mace, while at lower left a warrior narrowly fends off an arrow with his shield and sword. The circular arrangement of the warrior figures moves the viewers' gaze around the composition and heightens the scene's sense of drama. While the battle is the focus of the scene, the artist has taken care to render the mountainous terrain, which grounds the figures in a sense of place. A rocky outcropping at left and the hills on the horizon are rendered in pinks, while two figures and flags seen peeking over the crest suggest the action of battle continues, and is about to spill out of the frame.



This lacquered painting, probably produced in late-nineteenth to mid-twentieth-century Iran, illustrates a poem attributed to the twelfth-century Persian mathematician, astronomer, philosopher, and historian ʿUmar Khayyām:

> ***Comrades! I pray you, physic me with wine,***
> ***Make this wan amber face like rubies shine,***
> ***And, if I die, use wine to wash my corpse,***
> ***And frame my coffin out of planks of vine!***
> (q. 139 tr. Whinfield, 1883)

In the scene, a seated bearded figure reaches out to receive a basin from a young man, while a woman leaning against vines in a garden looks on. The triangulation between the young and the elderly, the gender distinctions between the young on the one hand and their angular vitality, as opposed to the seating rooted posture of the older man, on the other hand, suggest a competitive tension within the wheel of time between youth, knowledge, vitality and wisdom: the real unstated protagonist of this painting is time. The rich red tones of the painting and its wood frame recall wine, while the verses are written in elegant black nastaʿlīq script below. While this scene and verse appear secular, some scholarly interpretations of the Rubāʿiyāt poems have suggested that they should be read with Ṣūfī allegory in mind; drunkenness is commonly used in Ṣūfīsm as an allegory for religious ecstasy. A painting like this one could possibly have been produced for tourists familiar with the Rubāʿiyāt.

Ms Or 455, [Framed lacquer painting] illustrating verses of the Rubāʿiyāt of Omar Khayyam, Painted lacquer panel, wood frame, [Iran?], [18--?-1950?]. RBML

MS Or 405 GREY BOX, [Two Persian miniatures], [India?], 1800(?). RBML, Presumed to be a gift of David Eugene Smith, 1931-1934.

Two folios from an unknown manuscript, 19th century, India Ink and watercolor on paper. These folios are from different chapters of the same nineteenth-century manuscript, which appears to be a text of didactic parables, possibly a Naṣīḥatnāmah or Anwār-i Suhaylī. For example, one folio (1r) includes advice that might be paraphrased by the English proverb "Keep your friends close and your enemies closer"; the reader is reminded not to be too distant from their foes or rely too heavily on the continuing friendship of their allies.

Though written in Persian, this manuscript was produced in India, and the illuminations reflect an Indo-Persian style of painting. The architectural spaces depicted resemble Mughal palace architecture, while the figures' jewelry and clothing are distinctly Indian. The compositions and palettes are strikingly similar: in both illuminations, a seated royal in a jeweled crown receives visitors in a palace courtyard. The bearded royal in Fol 2r, however, is depicted as a higher status individual (or perhaps as the same individual later in life), seated on a jewel-encrusted cushion or throne, wearing more elaborate jewelry, and accompanied by an attendant with a fly whisk. Two members of the seated audience seem to whisper to each other, leaving us viewers to wonder whether they are the true friends or the foes of the ruler who are part of an intrigue. The figure in Fol 1r, by contrast, has a sparse beard, minimal adornments, and sits upon a plain cushion, possibly indicating a younger ruler or a less important member of the royal family.

MS Or 424, Ottoman Turkish expansion on al-Būṣīrī's Qaṣīdat al-Burdah, Arabic text in red, of al-Būṣīrī's poem known as al-Burdah accompanied by an Ottoman Turkish poetic expansion and translation, 1600. RBML

This copy of al-Būṣīrī's Qaṣīdat al-Burdah, penned by ʿAbd Allah al-Wahbī around the 17th c., is a rendition and addition to the original Qaṣīdat al-Burdah. Originally penned by the Ṣūfī Imām al-Būṣīrī in 13th century Egypt as a way of interceding to God through the Prophet Muhammad, the Qaṣīdat al-Burdah has been traditionally venerated throughout time, with over 20 renditions, 90 commentaries, and 15 translations. Part of the distinctive musical genre, *Madīḥ Nabawī* (elegies in praise of the Prophet), which includes a variety of poetic and musical forms and genres such as *Madīḥ nabawī*, *qaṣīdah*, *muwashshaḥ*, and *zajal*, the recitation of *al-Burdah* is based on a science of melody and precise musical structure called the Maqāmāt. It is often recited with performative elements intended to inculcate and represent a closeness in time and space to the prophet for those who recite it.

The celebration of the al-Burdah is multifold; it is celebrated as musical poetry, a talisman, a form of *dhikr* (by remembering Allah and His Prophet Muhammad and seeking connection to them through invocation and ritual performance), and an expression of *maḥabba*, love.

As part of the vocal genre of *qasidah*, traditionally, a soloist may take great melodic and rhythmic liberties, improvising as he goes. This improvisation element allowed for further instrumental development and literary additions to the original text throughout the years. The *al-Burdah* often became the foundation for other Qaṣīdas and poems. ❖

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Beyond the Text: Calligraphy as a Contrapuntal, Devotional and Scientific Art

اقْرَأْ بِاسْمِ رَبِّكَ الَّذِي خَلَقَ(١) خَلَقَ الْإِنسَانَ مِنْ عَلَقٍ (٢) اقْرَأْ
وَرَبُّكَ الْأَكْرَمُ (٣) الَّذِي عَلَّمَ بِالْقَلَمِ (٤) عَلَّمَ الْإِنسَانَ مَا لَمْ يَعْلَمْ (٥
(Q96:5)

Read, 'O Prophet,' in the Name of your Lord Who created—created humans from a clinging clot. Read! And your Lord is the Most Generous, Who taught by the pen—taught humanity what they knew not (Q96:5)

Islamic calligraphy is often considered the epitome of the expressiveness and beauty of Islamic art. God is described as the Master Creator of Forms (*al-Khāliq*, *al-Bāriʾ*, *al-Muṣawwir* Q59:24) and as "the Most Generous", "Who Taught by the pen" (96/3-4), ("*'allama bi-al-qalam*"). The Quran, sometimes referred to as *al-Kalam al-Sharīf*, the Noble Word, has also led to the antonym *al-Qalam al-Sharīf*, the Noble pen: the beauty of the Quran's content, its stories, rhythms, allegories and words had to be mirrored into a beautiful form of writing. As Islam spread across geographic regions and cultures, by the end of the 10th century, Arabic had become the lingua franca of the Islamic world. Arabic was the language of the Quran and of faith more generally, as well as of learning, literature, culture, travel and commerce. With the spread of the Islamic empire, Persian soon followed suit as the language of culture and learning. Although Arabic, along with Persian and later on, Ottoman Turkish, attained preeminence, vernacular languages were nonetheless retained in day-to-day life and flourished locally. This was a multilingual world, with the Arabic alphabet serving as a "unifier" that made for a common ground among a variegated and expansive set of social and cultural communities. Calligraphers were entrusted with copying God's Word, an ultimate honor that demanded skill, dedication, precision, and a high level of spirituality and devotion.

In a multitude of forms and through a variety of techniques and crafting skills, calligraphers used Quranic verses—along with Arabic, Persian, Ottoman, Urdu sayings, poetry and proverbs—to adorn arches, columns, corners, doorways and entryways of mosques, homes and palaces, as well as jewelry, book covers, reading tables, amulets, and small decorative objects. Some of these calligraphic decorations using poetry or other common sayings had little to do with the overt practices of the faith, e.g., those for wine bowls, but were simply part and parcel of *adab* (culture, good manners, good taste), as practiced amidst all the shifts in patronage and consumption of art within the Islamicate lands. Others integrated Qur'anic verses into the domestic and everyday sphere through a multitude of calligraphic ornamentation of the everyday objects and dwellings, thus conveying the omnipresence of God and creating a fluid relationship between the visual arts, writing, faith and everyday life.

Calligraphy puts on display a remarkable interplay between form and content, text and image, something commonly seen in Islamic art, particularly in the arts of the book, where text and image combine in striking ways. Through calligraphy the word, adab, or belles lettres, the text is put in dialogue with visual images; and in turn the image shapes and expands on the text. Calligraphy has thus been likened to the art of music thanks to its deployment of something akin to counterpoint to create a multitude of thoughts, ideas, feelings, and affective states through the application of simple yet precise rules that exploit the interplay of words and the forms to achieve its effects.

While Islamic calligraphy takes a wide variety of forms and styles, it is grounded in a very precise set of *usul*, or rules, for proportioning the size and length of each letter on the basis of an exact number of diamond-shaped (rhomboid) dots, commonly known as *nuqṭah* (dot), for each letter. For example, the length of an *alif* is made of eight rhomboid dots (a size that varies by pen nib and script style).

The formed *alif* becomes the diameter for an invisible circle that determines the *nisbat* (proportion) for all other letters. The letters, words, and sentences are then arranged within the rules of *tarkib* (composition) to create harmony and beauty for the reader. Each letter is seated on *khatt* or *kursi*, an invisible line that ensures a balanced symmetry between the written matter, background, illuminations, and "boldness" and "faintness" of the space. While scripts such as *naskh*, *thuluth*, *muhaqqaq* follow these principles strictly, scripts such as Maghrebi and Ottoman evolved across time and geography to incorporate different elements.

MS Or 271, *al-Qur'ān*, [Iran?], [18--?]. RBML, Gift of George Arthur Plimpton, 1936

This complete copy of the Quran, produced in Iran in the 19th century, is written in both *naskh* and *thuluth*. Clear and simple, and akin to contemporary "freehand writing" with minimal control and rules, naskh is one of the most common scripts (popular in Egypt and the Levant, but also used in Iran, India, Anatolia, etc. where Arabic is not the main language). *Thuluth* (Arabic: "one-third") is one of the scripts known as the 'Six Pens' or proportioned scripts (because the letter sizes are in proportion to one another). It is a large, elegant, cursive and expansive script, and is often used in mosques for calligraphic decorations above doors, mihrabs and columns. It is distinguished by the fact that one third of each letter slopes—in this case, notice the slight slant to the right and the long tail that "encircles" or cradles the following letters without piling up. Sloping creates an effect of undulation, as well as of "rounded containment" and rhythm.

The verses of *al-Fatihah*, the opening surah of the Quran, are framed with a squared band with floral decoration, and the ayas are each separated by a golden cloud. Around the floral arabesque-like square frame, there are two columns on each side displaying golden clouds with vegetal patterns in blue, gold and orange, helping to create the impression of an architectural portal and two majestic columns on each side. The columns are topped by a lavish overhead decoration of floral patterns framed in brown, where the title of the surah and the identification of the location it was revealed (Mecca, as in the case, or Medina) are written in white. The whole page is lavishly decorated with cloud bands in gold and blue, with orange flowers and golden leaves drawn inside the bands. Every page has a foliate marginal fill and a border-ruled textblock in orange, blue, and gold. Most pages are gold-sprinkled, and larger lines alternating between red on a white field and black on a gold field can be seen; marginal section divisions and some sūrah titles are in white ink on a gold field. While this is obviously a "luxury" Quran, the muted gold and deep blue colors together with the finely chiseled cloud decorations create a sense of a liminal space, looking up to the Heavens.

MS X892.8 M311, Gulāb Rā'ī, Fadwá (f.), active 19th century, *Calligraphy samples in Persian*, Agra, India, [1823-1858?]. RBML, Gift of Alexander I. Cotheal

This album of various calligraphy samples from India is undated, but likely copied in the first half of the 19th c. (1823-1858?). The colophon states that the author and calligrapher is Fadwá Gulāb Rā'ī, a (female) inhabitant of Tajganj [Agra], and a student at the Madrasah of Sarkar Faiz East India Company (Angrez Bahadur) (f. 42r), which is probably the Agra University, founded in 1823 (now known as Dr. Ambedkar University). What we see here are two zoomorphic calligraphic depictions: a tiger on the right and a bird on the left. Their cursive style allows the Arabic letters to be bent and re-proportioned in ways that can then fit within the image of an animal, flower, or vegetal pattern. It should be noted that zoomorphic calligraphy demands a high level of skill and consistency: the calligrapher must not only fit the letters into the intended (animal) shape in this case (composition/ tarkib), but also to follow the rules and proportions of the specific script she is using (respect for the elements (uṣūl), proportions (*nisbat*), and seating (*kursī*).

The text of the tiger comes from a part of the first sura of the Quran, al-Fātiḥah: "*bi-ism Allāh al-Raḥmān al-Raḥīm; Māliki yawm al Dīn, iyyāka na'budu wa iyyāka nasta'īn*" (ayat 3-4): "*In the name of God, the most Merciful, the most Compassionate, Itis You we worship, it is You we ask for help*".

The text of the bird on the left is a portion of a verse from the Quran, and it reads as follows: "Ayat Bayyinat"; "clear signs/verses" (referring to God's creations as clear signs of His Existence)

MS Or 222, *al-Qur'ān*, [Iran?], completed in Ramaḍān in 1140 AH by the scribe Muḥammad Muḥsin al-Iṣfahānī (f. 392r), probably in Iran, 1728.
RBML, Gift of David Eugene Smith, 1931-1934

This copy of the Quran, with interlinear Persian translation, from the 18th c. (1728 CE) exemplifies how material culture was put at the service of embodying and exemplifying, as well as solidifying crucial tenets and practices of emerging Islamic societies.

The item on view includes several scripts: the main Arabic text of the Quran is in *naskh*, the translation in Persian is in *nasta'liq*, the *surah*'s heading is in *thuluth* and the one line in gold at the center of the page is in *muhaqqaq*. Scripts can be combined to create beauty, but also to help orient the reader within the text. The use of alternate scripts with different dimensions and the overall visual layout of the page (e.g a composition of 22 gold-ruled lines alternating full and half height, with Arabic in the full height and Persian in the half-height) allow for a clear delineation of the Persian translation of the meaning of the Quranic verses. The interlinearity inserted onto the text orients the reader to different receptive modalities, and clearly indicates that the Persian text is a translation, and hence constitutes an interpretation of the text. It also clearly demarcates and elevates the Arabic text's status. Scripts and material cultural elements are not only put in the service of a translation, but also serve as an acculturation to converts and/or non-native speakers.

Tin plate used for lithography, [Undated, probably early 20th c.]. RBML

Tin plate, used for producing lithographed copies of the Quran. On the verso, Sūrah al-A'raf 54-55 is engraved, and on the verso, Sūrah al-Kahf 106-110. Even though printing not from movable type, but through *tarsh* technique (block printing) had long existed in the medieval Islamic world (see the ground-breaking article by Richard Bulliet), lithography was widely and commercially introduced to this world in the early 19th c. It was perceived as having several advantages over movable type printing, including its ability to preserve longstanding aesthetics of scribal cultures. Lithography coexisted in the Muslim world with manuscripts production as the most common technique for printing and lithographed books tried to emulate the long standing scribal practices, by imitating the page layouts and the cursive scripts of the handwritten manuscripts using illumination devices, akin to frontispieces and headpieces, called a *sar-lawh* or *ʿunwān*. Regions where the simple *naskh* script (not as elaborate as other calligraphic styles) was not very popular—in particular India, North Africa, and Iran—saw a special interest in lithography.

From the 19th century through the first decade of the 20th, India was at the hub of a great expansion in lithographic printing. In India and Iran, where Arabic printing had been introduced in 1814 and 1817 respectively, the lithographed book became almost a traditional craft. As Abdul Halim Sharar observes, in his book *Lucknow: The Last Phase of an Oriental Culture*, OUP, 1991: "At first printing was not undertaken on a commercial basis but purely as a private pursuit. The finest quality paper, highly appropriate for lithography, was used and the best calligraphists were employed at high salaries. [...] For the ink, thousands of lamps of mustard-oil were lighted to produce fine-quality lampblack. Instead of acid, fine-skinned lemons were used and sponges took the place of cloth. In short, only the finest materials were employed. As a result, Persian and Arabic educational and religious books in the days of the monarchy could not have been printed anywhere else but in Lucknow, where they were produced, irrespective of cost, for discriminating eyes. Books printed at that time represent a fortune to those who possess them. People search for them but cannot find them."

UTS Ms Arab 1, al-Qur'ān, [13--?-14--?]. Burke Library at Union Theological Seminary

This beautiful 14th or 15th c. copy of the Quran, written in pointed *naskh* and in black ink, displays a gilt frame with scrollwork lined in black (f. 2r), in addition to *finispieces* in gold and red with braid frame (f. 109v-110r) and gold marginal medallions with red, black, or blue centers marking text divisions. Juz' divisions were added at a later date. The delicate naskh hand, the precise vocalization in red and the shamsa medallions with green, blue or red centers create a sense of intimacy and infinite delicacy for this otherwise "grand" copy.

The manuscript has an interesting and typical Islamic binding: red-brown leather over a pasteboard with a central mandorla, and four blind-tooled lines extending in the cardinal directions and a blind-tooled frame; there is a coordinating stamp on the flap, and a yellow paper *doublure*.

MS X893.7K84 I25 F, Samarkandskīĭ kuficheskīĭ Koran, po predanīi͡u pisannyĭ sobstvennoruchno tret'im khalifom Osmanom (644-656) i nakhodiashchīĭsia v Imperatorskoĭ S-Peterburgskoĭ publichnoĭ biblīotekie, St. Petersbourg, 1905. RBML

Known as 'Pissareff's copy of the Quran of Uthman' or the "*Samarkand Quran*", this copy of the Quran was gifted to the Rare Book and Manuscript Library at Columbia in 1905. It is believed to be a copy of the famous Quran of ʿUthmān ibn ʿAffān, the third caliph (murdered in 656), and was issued in 1905 in 50 copies, using reprographic techniques. The copies, keeping to the form, shape and size of the original, were produced on paper (rather than parchment) and written in black ink. Though criticized for their clumsy production and grammar mistakes, the calligraphy of the 'copy' kept the beauty of the Kufic writing of the original one. The imposing size of this copy, and its attempt to recreate the original with precision, give this work stature. By incorporating clear elements that refer back to the original copy, and by deploying a self-referential trope indicating the status of the current copy as a copy, rather than as an original, this artifact questions our understanding of what may count as an original or a copy of a manuscript. Notice the dotted lines on the upper corner that refer back to the original size and shape of the Samarqand Quran, also note the added sūrah floral separations which were penciled in and colored after the reproduction was completed.

The current site of the original copy of the Qur'an of Caliph 'Uthman on which the Pissaref copy is based, is the Khoja Akhrar mosque. It is a large-sized Qur'an written in Kufic on parchment, unvoweled and with no punctuation as with many early Qurans. It is believed that this copy of 'Uthman Quran was brought as booty by Timur to Samarkand following the Mongol invasion of Iraq and Syria (accounts differ as to whether it was brought from Kufa or Basra, Baghdad, where the Abbasid's capital was established, or from Damascus, where the Umayyads had their capital). In 1869, the Qur'an was acquired by the Russian commander of the Zariavshansky district, Major General Abramov, for 500 Kokans (100 Rubles), and was sent by the Adjutant General Konstantin von Kaufman I, governor general of Turkestan, as a gift to St. Petersburg Public Library. With the manuscript's transfer to Russia, a new interest in the Quran of

‘Uthman arose, and in 1891 Shebunin published this important Quran and dated it to the second century A.H, i.e., the 9th century, and identified its place of production as Iraq. Since 1891, this manuscript has been the focus of several studies by various scholars, including most recently Rezvan and Déroche, both of whom suggested an earlier dating of the second half of the 8th c., and Iraq as the place of origin.

MS Or 308, [*al-Qur'ān*], [Iran?], [17—or 18--]. RBML,Presumed gift of George Arthur Plimpton, 1936

On display is a beautiful miniature early 18th c. Quran inside a small octagonal silver box with a finely decorated mother of pearl both top and bottom. The box is attached to a finely worked textile carrying band into which prayers are woven. The miniature Quran is about two inches wide and three quarters of an inch thick, and is written in *nastaliq* on handmade paper. As is traditional, the Quran also includes a complete table of contents. Probably a gift to a wealthy child, the box was probably intended to be worn over the right shoulder and under the left arm. The original cover of the Quran has been replaced (probably worn out), and the current cover is only sixty years old.

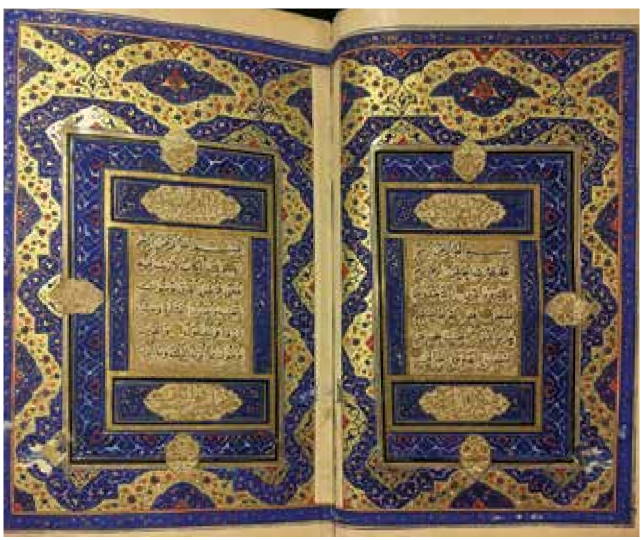
The technique of writing with great precision in such small script, often called *ghubari* (from ghabra, dust) clearly required expertise and training: miniature Qurans worn for protective purposes (sometimes inside a silver jewelry amulet, or as in this case, with an intricately woven band as a shoulder band or belt) were written in all sorts of scripts, ranging from ones which have spare angularity to those with rich curves. Miniature Qurans such as these perhaps embody most clearly the adage that within Islamic traditions, calligraphy is the supreme art of conveying God's Word and Omnipresence.

MS Or 404 GREY BOX, Ḥāfiẓ, active 14th century, *Leaf with ghazal of Ḥāfiẓ*, [Iran or India?], [17--?]. RBML, Gift of David Eugene Smith, 1931-1934

This beautiful leaf (18th c.) holds three spiritual ghazals from the famous Persian poet Ḥāfiẓ, born in Shiraz, Iran (14th c.). Medieval Persian poets such as Ḥāfiẓ embraced the Arabic poetry genre of *ghazal*, which dealt primarily with loss and love, and developed it into a major genre for sufi poetry, focusing on divine love and spirituality. Ghazal follows specific rules of composition: each couplet has the same length and meter and ends with the same *radif* (poetic refrain) and *qafiyah* (poetic scheme).

The three verses on display here are written in *nasta'liq*, commonly referred to as "the bride of scripts": merging the *naskh* script (valued for clarity and balance) and the *ta'liq* script (favored for efficiency), *Nasta'liq* was often a preferred script for writing poetry since it allowed the letters of the hemistichs to pile up beautifully against the intercolumn ruling. The three verses (seemingly fragments or beginnings of various poems), divided by intricate pink and gold polychrome flower bands, read from top to bottom as follows: "saḥar bulbul ḥikāyat bā ṣabā kard" [At dawn the nightingale told his story to the zephyr: Oh, what trouble has the love of the rose' s face brought to me!]; "saman būyān ghubār-i gham chū binshīnand binshānand" [When those who are fragrant like jasmines sit, they settle the dust of sorrow]; "sāqī ḥadīṣ-i sarv va gul va lālah mīravad": [O wine-boy, the tale of cypress, rose and tulip is being unfolded, And this discussion goes with three cleansing gulps]

References: *[Ḥāfiẓ, The Poems of Hafez translated from Persian by Reza Saberi. Lanham: University Press of America, 1995.], and [Ḥāfiẓ, (2007) The collected lyrics of Háfiz of Shíráz, translated by Peter Avery, Cambridge: Archetype].*



A 16th or 17th c. complete Quran, 6 lines to the page, written in elegant *naskh* script in black ink, each line surrounded by golden clouds, diacritics in black, verses separated by golden roundels. The surahs' headings are in *thuluth*, written in gold, with blue polychrome illuminated panels; margins are ruled in gold, double framing with cloud bands interspersed with floral motifs, in blue and gold. This is a grand copy that creates an expansive feeling of crossing a welcoming threshold: the illumination and the calligraphy work hand in hand to remarkable effect. Each line floats in the cloud bands, and each *aya* is punctuated with dark golden roundels- the same golden hue that outlines the cloud bands and makes up the headings and footings. (Blue and gold are frequently used to evoke the heavens and divinity, which makes these colors particularly fitting for use in a Qur'an.)

Qurans such as this were crafted to represent the word of God as well as to instill in the viewer a profound sense of admiration and awe. While the text of every copy of the Quran is identical, calligraphers and illuminators developed extraordinary creativity and originality to create an experience of the Quran as both a spiritual instrument and a conduit to the sublime.

The very rich blue seen here is a concentrated lapis pigment and therefore particularly expensive. The lavish use of such materials and the fact that the decorative illuminations take up most of the pages, reveal that this is a particularly high quality manuscript.

MS Or 316, [*al-Qurʿān*], [Iran?], [155-? to 165-?], Naskh script. Illuminated. Lacquered and floral cover. 26 x 16 cm. RBML, Gift of David Eugene Smith, 1931-1934 (PersonalPhoto)

Quran folding table, inlaid mosaics [North Africa?], [Undated]. RBML

Table of inlaid mosaics in warm hues of yellow and green, of unknown provenance. Geometric ornamentation, repeated in various complex patterns, reached a height of sophistication in Islamic art and architecture and came to define a highly abstract Islamic aesthetic. While Islamic geometric architectural ornamentation incorporated previous elements from Greek, Roman, and Sasanian cultures, it stressed even further the use of repeated patterns as a way of displaying and embodying harmony, simplicity, and infinity.

The advanced work of Islamic scientists, astronomers, mathematicians, physicists, and artists was essential to the development of this new aesthetic. Basic geometric forms such as the circle, the square, the line, and the dot were combined in intricate and complex ways, offering the possibility of expansiveness, freedom and creativity. The execution of repetitive and complex combinations of simple motifs in various media required skilled craftsmen (e.g., stonecutters for muqarnas, layers of mosaic, woodworkers, and glassmakers). Foldable tables such as this were used for reading the Quran, a common item found in mosques and in traditional homes permitting readers of the sacred text to sit comfortably on the floor.

Reference: *Department of Islamic Art. "Geometric Patterns in Islamic Art." In Heilbrunn Timeline of Art History. New York: The Metropolitan Museum of Art, 2000–.* www.metmuseum.org/toah/hd/geom/hd_geom.htm.

MS Or 312—FOLIO, [al-Qurʿān], [Iran?], [15--?]. RBML, Presumed gift of George Arthur Plimpton, 1936 (Personal Photo)

This stunning complete muṣḥaf with gold-sprinkled calligraphy is followed by a double-page "Duʿa baʿd tilāwah al-Qurʿān" (following 299b-300a), "prayer for finishing reading the Quran". The colophon states that it was completed in Dhū ʻal-Qaʿda 777 (March-April 1376), though this is unlikely in part because the illumination style suggests Safavid production in the 16th c. The illumination is splendid, with a double page illuminated frontispiece, some shamsa roundels (on 3b-4a), and marginal verse markers in blue and gold and Surah headings on a lighter blue ground. The calligrapher's name (illegible) is signed, suggesting that this was made by a master. The different pigments of blue used in this copy, the fine hand, the white borders of the floral motifs, the combination of arabesques and floral motifs show that this is another grand copy, this time in the typical lavish Safavid style of the 16th c. ❖

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Curatorial Window

How did we put this exhibit together? Who worked behind and in front of the scenes?

The making of this exhibit required the collaboration of a very broad range of players, across various units at the Libraries and various Institutes and Departments at the University. It involved: students, faculty members, librarians, conservateurs, digital experts, designers, each bringing a very broad range of expertise. The people who made this exhibit possible are too numerous to acknowledge here: not least of which because it is always hard to draw a clear line for the beginning of a collection, or of engagement with a collection.

Our curatorial team consisted of the following members:

Kaoukab Chebaro (Global Studies, Columbia University Libraries), Olivia Clemens (PhD candidate, Art history Department), Aneka Kazlyna (graduate student, MESAAS), Arwa Palanpurwala (Islamic Studies MA Student, Middle East Institute- GSAS,), Prof. Tunç Şen (History Department), Prof. Marwa Elshakry (History Department), Prof. Avinoam Shalem (Reggio professor, Art History Department), Julia Tomasson (graduate student, History Department), Yusuf Umrethwala (Islamic Studies MA Student, Middle East Institute-GSAS), Navid Zarrinnal (PhD graduate, MESAAS).

- Window one was co-curated by Prof. Tunç Şen, Prof. Marwa Elshakry and Kaoukab Chebaro;
- Windows two and three were co-curated by Yusuf Umrethwala and Kaoukab Chebaro;
- Window four was co-curated by Kaoukab Chebaro and Navid Zarinnal;
- WIndow five was curated by Julia Tomasson;
- WIndow six was curated by Aneka Kazlyna;
- Window seven was co-curated by Aneka and Julia;
- Window eight was curated by Tunç Şen with support from Kaoukab Chebaro;
- Windows nine and ten were co-curated by Kaoukab Chebaro, Arwa Palanpurwala and Olivia Clemens, with advice from Avinoam Shalem.

Thank you to all who pitched in to make this possible!

People who helped with this exhibit are too numerous to list here, but we would like to single out the following colleagues who helped out in a variety of ways:

Jennifer B. Lee, Curator of Performing Arts Collections, is also in charge of the RBML Exhibitions Program. In that capacity she has been the one to pull the items selected for this exhibition for Kaoukab Chebaro and the other exhibition organizers, and has worked to shepherd the process from the beginning through installation.

Vanessa Lee, who helped with the design of the labels, and the poster.

Alexis Haggardon, **Nathalie Naor**, and **Emily Lynch** from the Conservation Department who put in a lot of care, time and effort in conserving, treating, mounting the various items on display.

Olivia Clemens, PhD candidate, Art history department

Aneka Kazlyna, graduate student, MESAAS

Peter Magierski, Middle East and Islamic Studies Librarian

Nick J. Patterson, Music Librarian (for his help with the audio-guide

Madiha Choksi, Digital Learning & Emerging Technologies Specialist, (for ehr help with the audio-guide)

Testaments from various members of our team regarding their experiences with the exhibit:

Julia Tomasson
PhD Student, Department of History

I am a historian of science and mathematics and a PhD student at Columbia University in the History department. I curated the "Euclid" window and also co-curated the window on the mathematical sciences. Working with manuscripts for this exhibit reinforced, invigorated, and also challenged a lot of the reading I had done on the history of science in the Islamicate world. Where exactly does our evidence come from to write these histories? What exactly is this evidence of? How has this evidence been used, abused and neglected? By tracing the history of each of these manuscripts as material objects from their copy date to our collection (most centuries old!), we see that their contents are only the beginning of the many stories they can tell. These books themselves have witnessed the rise and fall of empires, the intellectual life of their readers; these books and the knowledge they embody have endured. The biggest joy of being involved in this project has been in getting lost and found in the 'clues'—from finding an errant Farsi پ in an Arabic manuscript to reconstructing the name and date on an owner stamp by using four 'partial prints' from different manuscripts in the collection to finally figuring out a difficult diagram. But perhaps equally rewarding and perhaps more unique to working on something like a collaborative exhibit has been sharing in the frustrations and fun with others. Aneka Kazlyna and I were constantly getting side-tracked by incredible finds! And MS Or 309 continues to elude me and every expert I have shown it to. I look forward to working with it more!

Arwa Palanpurwala
Islamic Studies MA Student
Middle East Institute, GSAS, Columbia University

What did you do for this exhibit?

For this exhibit, I researched paintings, manuscripts, and material from the Muslim World, with a focus on 17-19th century Persia.

What did you learn?

I learned of the many contributions (with specific examples) of Muslims and Islamic Culture towards modern advancement. It was particularly interesting to learn more about the significance of material culture.

What did you enjoy most about the process?

I enjoyed the collaborative nature of this exhibit- I really enjoyed listening and reading others' work and appreciated the feedback I was given.

Is there a particular work or object that stood out to you, and why?

I was particularly fascinated by the astrolabes and their intricate details. The inscriptions, materials used, and functionality always distracted me from my actual work.

Natalie Naor
Technical Assistant VI
Conservation Department, Preservation and Digital Conversion Division
Columbia University Libraries

What did you do for this exhibit?

I fabricated all of the mounts necessary for this exhibit. These mounts are custom built to accommodate and support the unique shape of each individual item, which allows for their safe display over the exhibition's duration.

What did you learn?

Since books and other collection material all have different shapes, media, and preservation concerns, proficiency in mount construction only improves with hands-on experience. Each time a mount is built, there is an opportunity to add new methods and solutions to the toolbox. For this exhibit on Muslim world manuscripts, one of the common binding characteristics is a fore-edge flap which wraps around the front edge of the book's text block. With many examples to work with, we were able to develop an assortment of solutions to safely display books featuring this additional binding component.

What did you enjoy most about the process?

Working on exhibits is something I look forward to each semester. Besides the architectural challenge of constructing these mounts, the custom and very precise nature of each support requires that I work very closely with every collection item going on exhibit. Having the opportunity to handle and thoroughly examine such important historic material up close is a great pleasure, and one I certainly don't take for granted.

Is there an item that stands out to you? (do you have a favorite manuscript or object and if so why?)

SMITH 513 1505 Eu2 (Exhibit Case 5), Euclid, 1505, Euclidis Megaresis philosophi platonici Mathematicaru[que?] disciplinarũm janitoris: This printed book stands out to me because of its dazzling gilt, gauffered edges. As a graduate of the North Bennet Street School Bookbinding Program, who still likes to bind books in her spare time when possible, I deeply enjoy designing and applying edge decoration. Knowing firsthand how much work is involved in preparing the edge, gilding an even layer of gold, and then gauffering such an intricate design, this really speaks to the mastery of the binder.

Peter Magierski
Islamic Studies Librarian
Global Studies
Columbia University Libraries

This exhibit was highly collaborative and involved many curators. There were many logistics that needed to be taken care of to ensure consistency, as well as clear documentation and communication: once the preliminary selection of the manuscripts was done, I helped Kaoukab generate lists which were then shared with all curators to support them in their write-up and research of the individual sections and works. I tried to ensure that all titles, names and call numbers conformed to established standards of transliteration and naming conventions and that all items were accurately documented. I also helped with hiring students and processing their timesheets. Finally, I helped with the extensive work needed to prepare images and metadata for the exhibition catalog and I am now working with Kaoukab on the online version of the exhibit which will be launched later this Fall.

Because of my involvement with the Muslim World Manuscript project, where I worked with the students on the initial cataloging of many items, I was familiar with many of the manuscripts included in the exhibit, and this helped a lot. While I admire beautifully illuminated Qurans or manuscripts with Persian poetry I remain partial to Islamic amulets and talismans in our collection. I continue to be amazed by the beauty of the enclosures, the almost microscopic handwriting and the overall craftsmanship of these objects.

I am sure the exhibit will be well received and its online iteration which will be launched later in the Fall of 2022 will continue to educate and inspire scholars and non-specialists alike.

Emily Lynch
Conservator for Special Collections, Conservation Department
Columbia University Libraries

What did you do for this exhibit?

As one of the conservators for the libraries, I reviewed the condition of all of the items in the exhibit and performed a range of treatments on any materials with condition concerns, including mending tears, stabilizing losses, and flattening creases and folds. I also determined the appropriate mount for each item so they can be safely displayed.

What did you learn?

It was a great opportunity to discover the breadth and depth of the collections!

What did you enjoy most about the process?

Tackling some of the more challenging treatments and mounts for the exhibit. No two treatments are ever the same, but there were some unique problems to solve in how to treat and safely display some of the items.

Is there one manuscript or one object that stands out for you and why?

Definitely MS Or 326. It's a protective talisman on a large, thin sheet of translucent parchment. Parchment is fairly sensitive to moisture in general, but when combined with the thinness of the material and the historic damage from use, it was a tricky treatment. We also had to create a sealed climate-controlled package to protect it from any fluctuations in humidity while on display.

Vanessa Lee
Public Services Specialist, RBML
Columbia University Libraries

What did you do for this exhibit?

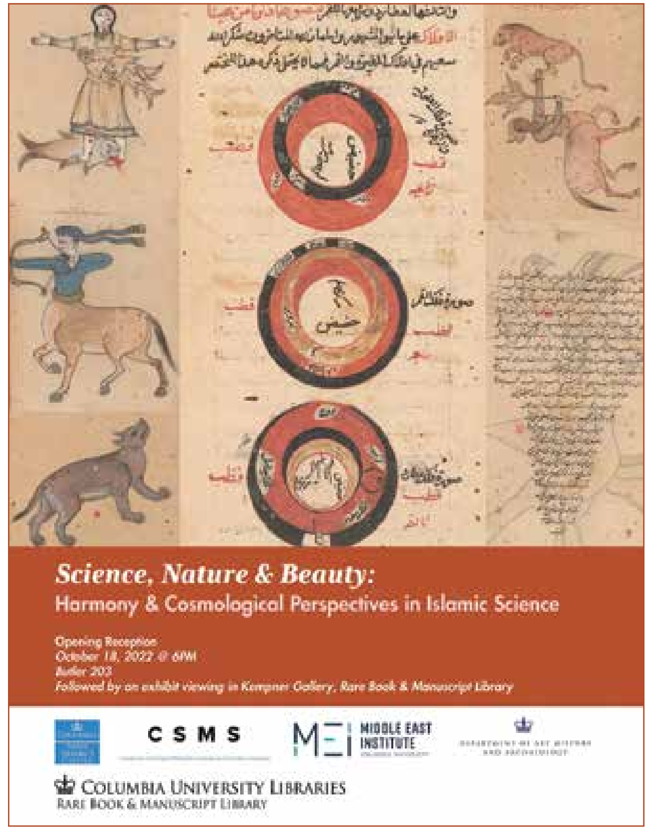
I'm the graphic designer for exhibit related work (labels, posters, etc). I also help with coordination and installation.

What did you learn?

Our Islamic manuscript collection amazes me and this was a wonderful opportunity to learn about the scope and breadth of our holdings.

What did you enjoy most about the process?

I think the best part about the exhibit process is the collaborative aspect. Everyone contributes their time and expertise to the project to foster the best outcomes.



Yusuf Umrethwala
MA student in Islamic Studies
Middle East Institute, Columbia University

My past research interests include the expression of emotional intensity and visceral imagery by the use of lingual derivations in the poems of Ṭayyībī-Ismaʿīlī Laureates of Yemen in the 13th century. In a more recent project, my research focused on the study of the trans-national socio-religious migratory history of his community, the Dawoodi Bohras starting from the early 19th century to the present day, my findings on which were recently self-published in a book entitled Travel and You Shall Prosper: The History of Migrations of the Dawoodi Bohras. This book covers the migratory history of the Dawoodi Bohras to over 40 countries from India across 9 geographical regions with a detailed account of the early migrants and community developments. Since nothing of this kind was previously documented, my work mostly relied on oral histories and ethnographic research and is also complemented with a rich collection of old images and archives, each of which tells and complements the vivid history of migrations. I hope to deepen my research and enrich my work. I also studied and wrote about the iconography of an old wooden artifact belonging to the Western Fatimid Palace in Cairo.

What did you do for this exhibit?

My past rewarding experiences always intrigued me about paleography and codicology. These interests compelled me to be a part of this exhibit. I worked very closely with Koaukab on windows 2 and 3. My main job was to situate the manuscripts under these themes in wider scholarship and academic contexts.

What did you learn? What did you enjoy most about the process?

One of the main rewarding experiences was peer learning and peer review. In my view, having the companionship of inspiring colleagues is a key to achieving excellence in any field and especially in academics. Through this exhibit, I learned the importance of teamwork and the art of receiving and giving feedback. One of the main challenges was studying manuscripts and themes that did not directly align with my research interests. However, stepping out of my comfort zone, reading and writing about new genres was a gratifying learning experience.

Tunç Şen
Assistant Professor, Department of History
Columbia University

What did you do for this exhibit?

For the exhibition, I curated Window 8, where we displayed a sample of items related to the rich tradition of occult scientific practice in the Muslim world. I also offered help with the curation of the items shown in Window 1 and reviewed the contents of Windows 2 through 7.

What did you learn?

It's been a tremendous experience to learn more about the hidden treasures, including scientific instruments, that have survived from the medieval and early modern Muslim world in the Columbia Rare Book & Manuscript Library. All these items were nicely put together, thanks to the great vision, excellent coordination, the careful selection and meticulous work of Kaoukab Chebaro, and of expert faculty and graduate students. This was my first time partaking in the curation of an exhibit. All the sound guidance I received to make the contents more accessible to a non-specialist audience will stay with me.

What did you enjoy most about the process?

The regular meetings with the team members where we exchanged ideas based on solid research were so stimulating and intellectually enriching.

Is there a particular work or object that stood out to you, and why?

Ms. 360 is my long-time favorite about which I had found a chance to write a short research article to explore its rich marginalia. The amulets, talismanic scrolls, and charts displayed in Window 8, some of which are preserved in beautifully decorated covers, also stood out to me.

Thank you so much for allowing me to be part of this fascinating project!

Marwa Elshakry
Associate Professor, History Department
Columbia University

We met fortnightly for the better part of the year to go through the many items that Kaoukab Chebaro so thoughtfully put together. It was a real joy to be able to work with this incredible trove of manuscripts (carefully collected, preserved, digitized and made accessible by our librarians across the years) and to collectively consider the ways in which they challenge, revise or refine older, Orientalist narratives about the history of science and Islam. This is sure to be a valuable resource for students and researchers in the future. It was also a pleasure to learn more about each individual item from our team of students, fellows and faculty who presented their curated works during our collective discussions.

Alexis Hagadorn
Head of the Conservation Unit
Columbia University Libraries

What did you do for this exhibit?

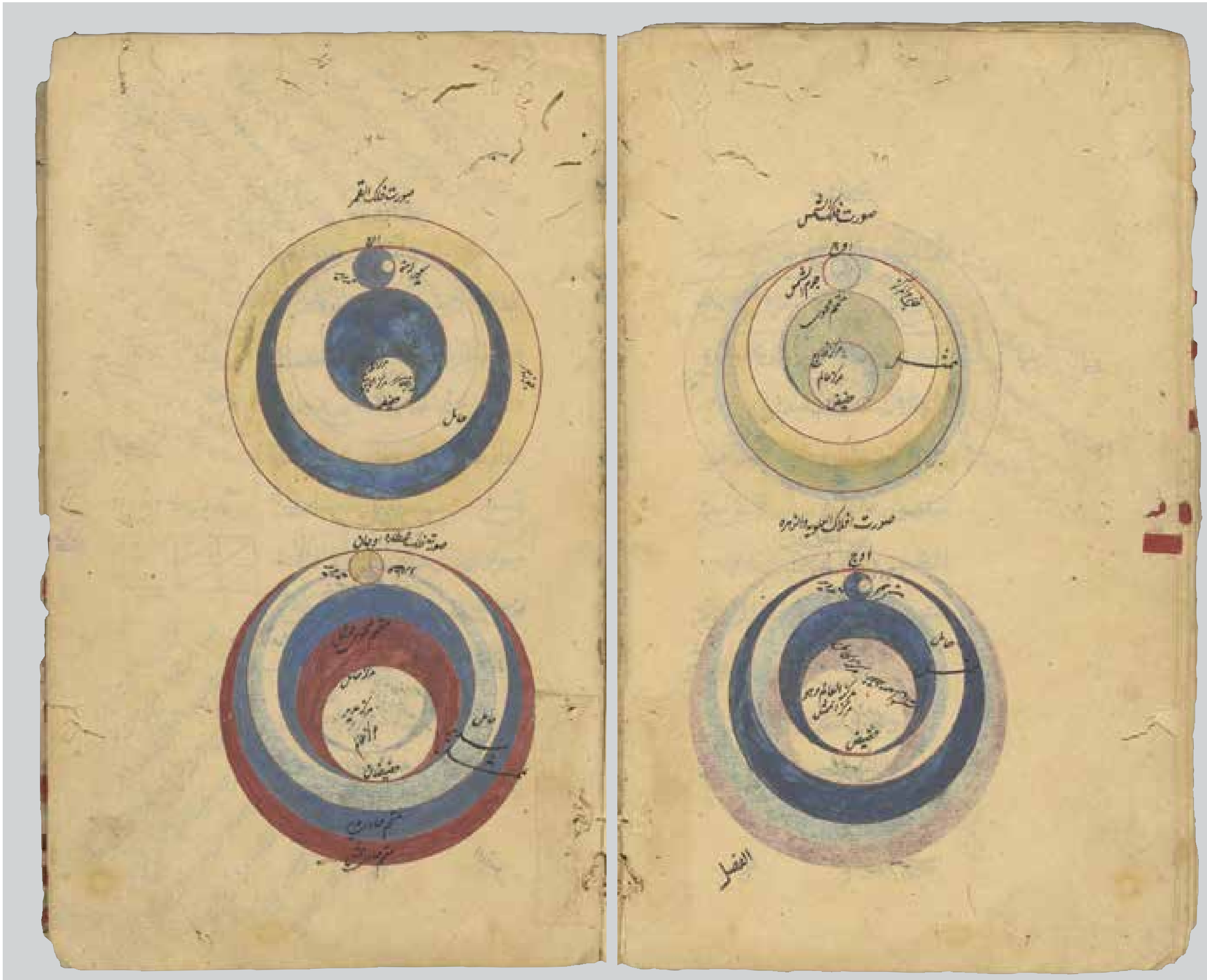
The Conservation staff members are part of the planning team for the exhibit. After the curators make their selections, we look together at each item—not only its condition, but also its exact position within the case, and which side, angle, or page the curators wish to show. Each of these choices leads to further decisions, as we match the mounting strategies to the needs of each. It's sometimes surprising to realize that the same book would require a new and entirely different mount if pages in a different part of the volume needed to be shown!

Is there an item that stands out to you?

I couldn't choose just one, but planning for this exhibit gave the team so many opportunities to delight in the evidence of highly refined craft practice in the Libraries' manuscripts. Making the paper, sizing and burnishing it, manufacturing the ink and pigments, writing and decorating the book and then binding it—sometimes with delicately lacquered covers—are all steps that create exquisite luxury objects. Our group also proved that one can swoon just as much over details revealing the hand of the maker that more refined skills would probably have rendered invisible—"Beautiful drawknife marks!" was one such joyful exclamation during our planning meetings.

Kaoukab Chebaro
Head of Global Studies
Columbia University Libraries

This exhibit was a true labor of love and a real learning experience for me. It demanded the best from me, but gave back many times over. I want to thank everyone who participated for the opportunity to learn alongside them, on so many levels, and most of all, for their companionship along this journey. The serious playfulness, communal spirit, humility and curiosity with which everyone approached this project were truly inspiring. I will cherish our discussions, our false starts, and our aha moments as one of the most beautiful learning experiences I have ever had. I hope we can continue to open our collections and ourselves to new communal experiences of growth.



MS Or 20, Taṣrīḥ fī sharḥ Tashrīḥ al-aflāk. / تصريح في شرح تشريح الافلاك (India?, 1800?-1899?, Item is undated. Perhaps produced in India in the 19th century.)

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