

Astronomy's climate emissions: global travel to scientific meetings in 2019 – Supplementary Material

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Hotel CO₂e emissions

In-person conferences require travel to the conference venue, and also — if not at a local venue — hotel accommodation. Staying at a hotel comes with its own environmental footprint, due to electricity consumption, heating and cooling, catering, as well as waste and wastewater disposal needs. To assess



Supplementary Figure 1: Emissions for travel and hotel accommodation for three exemplary trips, each with a stay of six nights at a hotel. The contributions to the overall emissions are from travel (yellow) and accommodation (blue). To first order, flight emissions scale with distance. Train travel produces substantially lower GHG emissions than flying, and, except for longer stays in combination with train travel, the contribution by hotel accomodation is a minor fraction of total emissions. For each trip, the contribution from hotel- and travel-related emissions are, respectively: 71.6% / 28.4% (Leiden - Munich by train); 29.8% / 70.2% (Leiden - Munich by plane); 2.7% / 97.3% (Perth - Shanghai); 1.0% / 99.0% (Cape Town - Vancouver with RFI=2); 0.5% / 99.5% (Cape Town - Vancouver with atmosfair RFI value). When comparing the impact of GHG emissions, the assumed radiative forcing index (RFI) for flights is important, as well assumptions on flight route length vs. great circles, and, potentially, the type of aircrafts. An RFI value of 1.95, as assumed throughout this study, is on the lower end of potential impact factors. Flight emission calculations through the atmosfair.de website are taking into account a higher RFI as well as typical aircraft types and real-world flight routes, which can result in substantially higher emission values.

the relative GHG emissions of accommodation versus travel we used data provided to us by atmosfair, who created and maintain emission calculation standards not only for means of travel, but also hotels¹. A typical hotel stay can emit from below 5 kgCO_2 per night for a standard single room of a 1- or 2-star hotel to beyond 40 kgCO_2 in a 4- or 5-star hotel. The emission will vary strongly between countries with low- and high fossil-fuel use for electricity and heating or cooling, and between smaller and larger rooms. Also, these are average numbers and will depend on the setup and situation of any specific hotel.

Depending on location, 5–40 kgCO₂/night over a number of nights amount to emission levels that can be comparable to those of travelling to a meeting location by rail, but are typically dwarfed by flight emissions. In Supplementary Figure 1 we show the contributions of emissions for travel and accommodation for a couple of representative trips with a 6-night stay: a \sim 800 km trip inside Europe from Leiden/Netherlands to Munich/Germany by train and plane, as well as trips from Australia to China, and South Africa to Canada.

For the intra-Europe train trip the accommodation will make up 55-70% of combined emissions — 20-30% when flying — but for the intercontinental trips it contributes only a few percent. This is, of course, due to the travel emissions being higher by factors of 10-25 in the case of intercontinental trips.

As a rule of thumb, we conclude that a hotel night has a typical GHG emission similar to ~ 400 km of train travel, or 60–100 km short-distance flying.

Emission contribution by travel distance

In order to compute the environmental impact depending on the type of travel, we investigate how the number of short-, medium-, and long-haul travel relates to the fraction of GHG emissions associated with each category. For simplicity, we combine long-haul and ultra-long haul travel, since only a very small fraction of travel is longer than 16 hours (0.2%). The distribution is shown in Supplementary Figure 2. Almost two thirds of all trips are short distance travel, which contributes about a fifth to the GHG emissions. Long and ultra-long distance travel, which is often intercontinental, constitutes 21% of all trips, but causes more than 60% of all travel-related emissions. Medium distance trips make up the smallest fraction of all trips (13%), and the related emissions make up almost another 20%.

Lists of all astronomy conferences and schools in 2019

In our analysis we consider 362 meetings, among which were 307 conferences and 55 schools. We list all countries hosting either conferences, schools, or both in Supplementary Table 1, sorted by continent. Supplementary Tables 2 and 3 list information for each individual conference and school, respectively, for which we could obtain information about the participants' origin that enabled us to assess the travel-related GHG emissions. Conferences and schools for which we were not able to retrieve the necessary information about participants are listed in Supplementary Tables 4 and 5.

¹Based on emission data by atmosfair gGmbH, Germany, "VDR Standard Part III", https://www.atmosfair. de/en/standards/emissions_calculation/co2_reporting_for_companies/vdr_standard_ methodology



Supplementary Figure 2: Nested donut charts displaying the number of conference trips taken and divided by classification (short-, medium-, and long-haul) in the inner ring, versus the total emissions produced for each category in the outer ring. The 'long-haul' classification includes trips with ultra-long distances, which make up 0.2% of all trips and 1.3% of all emissions.

Continent	Number of meetings	Country	Conferences	School
		Ethiopia	1	0
Africa	4	Nigeria	0	1
		South Africa	2	0
		Armenia	4	1
		Azerbaijan	1	0
		China	17	1
		India	9	8
		Iran	1	0
		Israel	2	0
		Japan	13	0
Asia	61	Kazakhstan	1	0
Asia		Malaysia	0	1
		Russia	4	2
		South Korea	1	0
		Taiwan	4	1
		Thailand	0	3
		Turkey	2	0
		Vietnam	1	0
		Austria	1	0
		Belgium	1	0
		Bulgaria	1	0
		Czech Republic	1	0
		Denmark	1	1
		Finland	2	0
		France	9	6
		Germany	21	3
		Greece	7	1
		Hungary	3	0
Furone	142	Iceland	1	0
Europe	142	Ireland	1	0
		Itelu	1	2
		Italy The Notherlands	23	2
		Deland	21	2
			1	5
		Foliugal	5 14	1
		Spain	14	2
		Sweden	3	0
		Switzeriand	4	2
		Ukraine	1	1
		Canada	22	1
		Canada	8	0
North America & Caribbean	65	Cuba	1	0
		Mexico	2	0
		United States	63	6
Oceania	21	Australia	18	3
		New Zealand	2	0
		Argentina	2	1
South America	7	Brazil	2	1
		Chile	3	0

Supplementary Table 1: Distribution of conferences and schools over different continents and countries.

Supplementary Table 2: List of all 258 conferences with participant data. The number of participants given in parentheses are the amount of local participants, which travelled less than 200 km per round-trip.

Metric Votice Interaction Consistent (CQ) Description (CQ) Part of the second (CQ)			Number of	Tot_travel	Emission per	Distance trav	Note
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Meeting name	Venue	participanta	emissions (tCO, a)	participant (tCO a)	by train	100
		Africa	participants	callissions (ICO2e)	participant (iCO2e)	by train	
Modeling Streeming Secure National PRA, Sonality 20.00 177.0 2.71 2.70 3.71 2.70 3.70 3.70 Modeling Streeming Natar Natar Natar 3.71 2.70 3.71 3.71 3.70	Complement of Cofori	Anica KuuzZulu Natal South Africa	76 (12)	175.0	2.20	< 200 loss	
Notice and the production of the second se	Cosmology on Salari	Kwazulu-Natai, South Africa	76 (12)	175.9	2.50	< 500 km	
Int. Symposium 3.58 - Notice Academy in galaxies Addit Addits, ranging PERC International Symposium on Data & Parent books (DP 2019) Teleyo, Japan 35 (15) 94.32 0.98 < < < < > < < < > < < > < < > < > < >	Modeling Meerkats: Comparing galaxy formation simulations to MeerkA1 surveys	Kruger National Park, South Africa	22(0)	37.01	1./1	< 300 km	
Alia Name Chain Prof. P	IAU Symposium 356: Nuclear activity in galaxies	Addis Ababa, Ethiopia	180 (20)	301.28	1.67	$< 300 {\rm km}$	One origin not back-traceable
She Chan, Chais B Haderial Action actions: UPD 2019) Kumma, Chais 70 (100) 186.01 2.4.9 < 700 km Device Shares and Shares and Shares actions and the store UPD 2019) Data, Link Shares actions and the store UPD 2019 Nancalaine, Jagan 17.6 9.1 6.000 km Device Shares and the Stophares Opy New, Vietnam 49.0 13.14 2.08 < 6.000 km		Asia					
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The Mereardengeh Sky. II. Coloraniza phe signal GMMPane, Inci157 (69)20.001.18< 500 inConval A Say and Lis hy ard for expand GMMOny Non-Neman49 (2)13.542.08< 200 in	PERC International Symposium on Dust & Parent bodies (IDP 2019)	Tokyo, Japan	35 (15)	34.32	0.98	$< 700 \mathrm{km}$	
Control Swamp and be its year of the upgraded CMRT Name and the its year of the upgraded CMRT Name and the its year of the upgraded CMRT Name and the its year of the upgraded CMRT Cornin LAB Name and Table Table Decoprimes Name and the its year of the upgraded CMRT 78 (23) 87 5.5 1.12 < 000 km	The Metrewavelength Sky - II: Celebrating the 90 th year of	Pune India	187 (69)	220.03	1.18	< 500 km	
Cosnic Lub Numenhon Japan [7 (6) 0.16 0.54 < Column Scarch for Life, from Early Early to Excipators Markins, Japan 76 (2) 81.51 2.60 Nm The 1r Dought Astrophysics From The cord Large-cale sky Kamime, China 121 (35) 53.0 0.46 < 200 km	Govind Swarup and the 1st year of the upgraded GMRT	T uno, munu	107 (07)	220.00	1110	< 000 mm	
Search for lif, from Early Early Discoplanes Quy None, Vertanan 40 (2) 81.52 1.26 < 000km	Cosmic Lab	Narashino, Japan	17 (8)	9.16	0.54	$< 700 \mathrm{km}$	
Extensionly big Fyos on the artly UniverseKnaming, China72 (2)87.21.12< 500 kmIter Is Libegui Astrophysis Form The artly directed by Marine Jonant ActionsKnaming, China121 (36)55.31.00< 300 km	Search for life, from Early Earth to Exoplanets	Quy Nhon, Vietnam	49 (2)	131.54	2.68	$< 300 \mathrm{km}$	
The Isongle Astrophysics Porum The era of Isopes and sky marroys: Near Medic consology and the documined set of the documined and the formation of the formation of the documined and the formation of the formation of the documined and the formation of the documined and the formation of the documined and the formation of the formation of the documined and the formation of the	Extremely big Eyes on the early Universe	Kashiwa, Japan	78 (22)	87.52	1.12	$< 500 \mathrm{km}$	
	The 1st Donglu Astrophysics Forum The era of large-scale sky	Kunming China	121 (36)	55 30	0.46	$< 1000 \rm km$	
VHEP Renomena Around Supermassive Black Holes Yervan, Amenia 47 65.83 1.40 < 200 km The ornelated Universe Sequeipo, Souh Korea 36 0 42.85 1.12 < 0.00 km	surveys: Near field cosmology and time domain science	Kullining, China	121 (50)	55.50	0.40	< 1000 km	
The bit International Workshope Occultation and Edipse (IWOE)Canakkale, Turkey40.816.290.41.2< 100 kmTal Alexander workshop: Dynamics and accretion near massive black holesTal Alexander workshop: Dynamics and accretion near massive black holesTal Alexander workshop: Dynamics and accretion near massive black holesTal Alexander workshop: Dynamics and accretion near massive black holesStanglad, China84.0311.231.23C 100 kmInternational Pulsar Timing Array Meding - 2019Pane, India94.1020.882.31< 000 km	VHE Phenomena Around Supermassive Black Holes	Yerevan, Armenia	47 (3)	65.63	1.40	$< 300 \mathrm{km}$	
The conclusid UniverseSouth Koreal3642.651.12< 1.00 kmRecent progress in relativistic attrophysicsTel Avon, Kunch66 (49)0.180.48< 1.23	The 9th International Workshop on Occultation and Eclipse (IWOE9)	Canakkale, Turkey	40 (8)	16.29	0.41	$< 1000 \mathrm{km}$	
Tal Accurater workshop: Dynamics and accretion near massive black holes Shangha, China 64,49 30.18 0.48 < 1000 km	The correlated Universe	Seogwipo, South Korea	38 (0)	42.65	1.12	$< 100 \mathrm{km}$	
Becen progress in calaristic storphysics Shanphal, China 84 12.5 1.28 < 100 km International Public Trings Args Weing ~ 2019 Astana, Kasakhstan 16 20.88 2.35 < 700 km	Tal Alexander workshop: Dynamics and accretion near massive black holes	Tel Aviv, Israel	63 (49)	30.18	0.48	$< 100 \mathrm{km}$	
International Palar Timing Array Meeting - 2019 Pame. India 94 (13) 20.88 2.35 < <700 km Exploring the Energie Universe 2019 Kanak Kaakksan 16 (4) 20.95 1.31 < 300 km	Recent progress in relativistic astrophysics	Shanghai, China	88 (4)	112.35	1.28	$< 1000 \rm km$	
Exploring the Energetic Universe? 2019 Astana, Kasakhatan 16 (4) 20.95 1.31 < 300 km	International Pulsar Timing Array Meeting - 2019	Pune, India	94 (13)	220.88	2.35	< 700 km	
Painer Science with Math-Wacelength Date. North Ecliptic Pole Meeting 2019 Hanchu, Taiwan 45 (20) 32,37 0.72 < 100 km	Exploring the Energetic Universe 2019	Astana, Kasakhstan	16 (4)	20.95	1.31	< 300 km	
IAU Symposium 337: Gladeic Dynamics in the En of Large Surveys Shanghai, China 81 (9) 219 91 2.71 < 1000 km	Future Science with Multi-Wavelength Data: North Ecliptic Pole Meeting 2019	Hsinchu, Taiwan	45 (20)	32.37	0.72	< 300 km	
Cosine DateNarashino, Japan $57(14)$ 76.51 1.44 $< 700 km$ Form ACN to starburtGuyang, China 107 15507 1.45 $< 700 km$ Gravity meets Plasm WorkshopKumming, China $44(0)$ 59.88 1.36 $< 1000 km$ Gravity meets Plasm WorkshopKumming, China $44(0)$ 59.88 1.36 $< 1000 km$ Active galaxies and quasarsByuraka, Armenia $22(15)$ 3.52 0.16 $< 300 km$ Active galaxies and quasarsByuraka, Armenia $71(6)$ 110.00 $< 2300 km$ Compact white dwarf binariesYervan, Armenia $64(3)$ 155.63 2.12 $< 300 km$ Compact white dwarf binariesYervan, Armenia $64(3)$ 155.63 2.12 $< 300 km$ Physics of Stars and Planets: Atmospheres, Activity, Magnetic fieldsShamakhy, Azerbaijan $111(42)$ 43.35 0.39 $< 300 km$ Physics of Stars and Planets: Atmospheres, Activity, Magnetic fieldsShamakhy, Azerbaijan $111(42)$ 43.35 0.39 $< 300 km$ Multi-messenger astrophysics in gravitational wave eraKyoto, Japan $105(23)$ 259.62 1.57 $< 700 km$ The UX Ori type stars and related topicsSaim Petersburg, Russia $29(13)$ 47.79 0.81 $< 300 km$ Paname Physics: Methods, Tools, and OutcomesYichang, China $110(3)$ 85.72 $0.70 km$ $< 1000 km$ New Horizons in Galactic Center Astronomy and BeyondYichang, China $100(20)$ 11.52 <	IAU Symposium 353: Galactic Dynamics in the Era of Large Surveys	Shanghai, China	81 (9)	219.91	2.71	< 1000 km	Participants estimated from programme
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	From AGN to starburst	Guivang China	107 (3)	155.07	1.45	< 700 km	
Dynamics of asteroids, TNOS & natural satellites with Gaia dataAntalya, Turkey29 (12)25.580.88< 300 kmActive galaxies and quasarsByurakan, Amenia22 (15)3.520.16< 300 km	Gravity meets Plasma Workshop	Kunming China	44 (0)	59.88	1.15	< 1000 km	
Active galaxies and quasarsInterview interviewInte	Dynamics of asteroids TNOS & natural satellites with Gaia data	Antalya Turkey	29 (12)	25.58	0.88	< 300 km	
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Compact white dwarf binariesYerevan, Armenia 64 (3) 135 , 63 2.12 < 300 kmChallenges and innovations in computational astrophysicsShin Hetersburg, Russia 102 (3) 84.40 0.83 < 700 kmPhysics of Stars and Planets: Atmospheres, Activity, Magnetic fieldsShamakhy, Azerbaijan 111 (42) 43.35 0.39 < 300 kmMulti-messenger astrophysics in gravitational wave eraKyoto, Japan 165 (28) 259.62 1.57 < 700 kmDiversity of the local UniverseNizhnij Arkhyz, Russia 52 (13) 77.79 0.81 < 300 kmSecond Workshop on Numerical Modeling in MHD andMoscow, Russia 29 (12) 17.82 0.61 < 500 kmPlasma Physics: Methods, Tools, and OutcomesMoscow, Russia 29 (12) 17.82 0.61 < 500 kmCosmic Evolution of Quasars: from the First Light to Local RelicsBeijing, China 110 (3) 85.72 0.78 < 1000 kmGamma-ray Bursts in the Gravitational Wave Era 2019Yokohama, Japan 164 (3) 12.92 < 1000 kmOrdigin for some participants not clearThe Kilky Kay Subscinet Scholtin of Quasars: from the First Light to Local RelicsBeijing, China 113 (9) 160.35 1.42 < 1000 kmGamma-ray Bursts in the Gravitational Wave Era 2019Yokohama, Japan 161 (51) 272.47 1.69 < 700 kmGamma-ray Bursts in the Subtilinet Array: Present and FutureTaipei, Taiwan 100 (26) 111.15 1.11 < 1000 kmScience virth	IAU South West & Asian regional workshop	Byurakan, Armenia	37 (16)	11.90	0.32	< 300 km	
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Physics of Stars and Planets: Atmospheres, Activity, Magnetic fieldsShamakhy, Aczenbigin111 (42)43.350.39< 300 kmMapping Central regions of AGNShamakhy, Aczenbigin112 (4)233.361.91< 1000 km	Challenges and innovations in computational astrophysics	Saint Petersburg, Russia	102 (3)	84.40	0.83	$< 700 \mathrm{km}$	
Mapping Central regions of AGNShanghai, China 122 (4) 233 , 36 1.91 < 1000 kmMulti-messenger astrophysics in gravitational wave eraKyoto, Japan 165 (28) 259 , 62 1.57 < 700 km	Physics of Stars and Planets: Atmospheres, Activity, Magnetic fields	Shamakhy, Azerbaijan	111 (42)	43.35	0.39	$< 300 \mathrm{km}$	
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The UX Ori type stars and related topicsSaint Petersburg, Russia59 (13)47.790.81< 300 kmSecond Workshop on Numerical Modeling in MHD and Plasma Physics: Methods, Tools, and OutcomesMoscow, Russia29 (12)17.820.61< 500 km	Diversity of the local Universe	Nizhnij Arkhyz, Russia	82 (23)	78.26	0.95	$< 500 \mathrm{km}$	
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The Milky Way 2019: LAMOST and Other Leading SurveysYichang, China110 (3) 85.72 0.78 < 1000 kmNew Horizons in Galactic Center Astronomy and BeyondYokohama, Japan 136 (37) 230.37 1.69 < 700 kmCosmic Evolution of Quasars: from the First Light to Local RelicsBeijing, China 112 (28) 144.23 1.29 < 1000 kmGamma-ray Bursts in the Gravitational Wave Era 2019Yokohama, Japan 161 (51) 272.47 1.69 < 700 kmTMT Science ForumXiamen Island, China 113 (9) 160.35 1.42 < 1000 kmOrigin for some participants not clear4th COSPAR Symposium: Small Satellites for Sustainable Science and DevelopmenHerzliya, Israel 258 (63) 434.16 1.68 < 300 kmScience with the Submillimeter Array: Present and FutureTaipei, Taiwan 100 (26) 111.15 1.10 < 500 kmJCM UsersTaipei, Taiwan 87 (40) 74.72 0.86 < 300 kmAstronomy for equity, diversity and inclusionTokyo, Japan 120 (20) 71.03 0.47 < 700 kmInternational Conference on Modeling, Machine Learning and AstronomyBangalore, India 196 (1) 141.75 0.72 < 500 kmInternational conference on Gravitation & CosmologyPunjab, India 196 (1) 141.75 0.72 < 500 kmInternational conference on Gravitation & CosmologyPunjab, India 196 (1) 141.75 0.72 < 500 kmYoung Astronomy: Yuee 2019 at Kodaikanal Solar Observato	Plasma Physics: Methods, Tools, and Outcomes	Woscow, Russia	29 (12)	17.02	0.01	< 500 km	
New Horizons in Galactic Center Astronomy and BeyondYokohama, Japan136 (37)230.371.69< 700 kmCosmic Evolution of Quasars: from the First Light to Local RelicsBeijing, China112 (28)144.231.29< 1000 km	The Milky Way 2019: LAMOST and Other Leading Surveys	Yichang, China	110 (3)	85.72	0.78	$< 1000 \mathrm{km}$	
Cosmic Evolution of Quasars: from the First Light to Local RelicsBeijing, China112 (28)144.231.29< 1000 kmGamma-ray Bursts in the Gravitational Wave Era 2019Yokohama, Japan161 (51)272.471.69< 700 km	New Horizons in Galactic Center Astronomy and Beyond	Yokohama, Japan	136 (37)	230.37	1.69	$< 700 \mathrm{km}$	
Gamma-ray Bursts in the Gravitational Wave Era 2019Yokohama, Japan161 (51)272.471.69< 700 kmTMT Science ForumXiamen Island, China113 (9)160.351.42< 1000 km	Cosmic Evolution of Quasars: from the First Light to Local Relics	Beijing, China	112 (28)	144.23	1.29	$< 1000 \mathrm{km}$	
TMT Science ForumXiamen Island, China113 (9)160.351.42< 1000 kmOrigin for some participants not clear4th COSPAR Symposium: Small Satellites for Sustainable Science and DevelopmentHerzliya, Israel258 (63)434.161.68< 300 km	Gamma-ray Bursts in the Gravitational Wave Era 2019	Yokohama, Japan	161 (51)	272.47	1.69	$< 700 \mathrm{km}$	
4th COSPAR Symposium: Small Satellites for Sustainable Science and DevelopmentHerzliya, Israel258 (63)434.161.68< 300 km1st Shanghai assembly on cosmology & galaxyShanghai, China100 (26)111.151.11< 1000 km	TMT Science Forum	Xiamen Island, China	113 (9)	160.35	1.42	$< 1000 \mathrm{km}$	Origin for some participants not clear
1st Shanghai assembly on cosmology & galaxyShanghai, China100 (26)111.151.11< 1000 kmScience with the Submillimeter Array: Present and FutureTaipei, Taiwan108 (51)118.651.10< 500 km	4th COSPAR Symposium: Small Satellites for Sustainable Science and Development	Herzliya, Israel	258 (63)	434.16	1.68	$< 300 \mathrm{km}$	
Science with the Submillimeter Array: Present and FutureTaipei, Taiwan108 (51)118.651.10< 500 kmJCMt UsersTaipei, Taiwan87 (40)74.72 0.86 < 300 km	1st Shanghai assembly on cosmology & galaxy	Shanghai, China	100 (26)	111.15	1.11	< 1000 km	
JCMt UsersTape, Taiwan $87(40)$ 74.72 0.86 $< 300 \text{ km}$ Astronomy for equity, diversity and inclusionTokyo, Japan $121(16)$ 289.1 2.39 $< 700 \text{ km}$ International Conference on Modeling, Machine Learning and AstronomyBangalore, India $150(20)$ 71.03 0.47 $< 700 \text{ km}$ Cities for origin of participants estimatedPlanet formation workshopTokyo, Japan $88(36)$ 71.02 0.81 $< 700 \text{ km}$ Cities for origin of participants estimatedInternational conference on Gravitation & CosmologyPunjab, India $196(1)$ 141.75 0.72 $< 500 \text{ km}$ Young Astronomers' Meet 2019 at Kodaikanal Solar ObservatoryKodaikanal, India $57(0)$ 21.26 0.37 $< 700 \text{ km}$ Modern Engineering Trends in Astronomy: Three years of AstroSat observationsBangalore, India $193(107)$ 25.14 0.13 $< 700 \text{ km}$ Multi-wavelength Astronomy: Three years of AstroSat observationsBangalore, India $20(5)$ 19.98 1.00 $< 300 \text{ km}$ International MeetingTaiwanTaiwan $176(84)$ 11.23 0.06 $< 500 \text{ km}$	Science with the Submillimeter Array: Present and Future	Taipei, Taiwan	108 (51)	118.65	1.10	< 500 km	
Astronomy for equity, diversity and inclusionTokyo, Japan121 (16)289.12.39< 700 kmInternational Conference on Modeling, Machine Learning and AstronomyBangalore, India150 (20)71.030.47< 700 km	JCMt Users	Taipei. Taiwan	87 (40)	74.72	0.86	< 300 km	
International Conference on Modeling, Machine Learning and AstronomyBangalore, India150 (20)71.030.47<700 kmCities for origin of participants estimatedPlanet formation workshopTokyo, Japan88 (36)71.020.81<700 km	Astronomy for equity, diversity and inclusion	Tokyo, Japan	121 (16)	289.1	2.39	< 700 km	
Planet formation workshopTokyo, Japan88 (36)71.020.81< 700 kmInternational conference on Gravitation & CosmologyPunjab, India196 (1)141.750.72< 500 km	International Conference on Modeling, Machine Learning and Astronomy	Bangalore, India	150 (20)	71.03	0.47	< 700 km	Cities for origin of participants estimated
International conference on Gravitation & CosmologyPunjah, India106 (1)141.750.72<500 kmYoung Astronomers' Meet 2019 at Kodaikanal Solar ObservatoryKodaikanal, India57 (0)21.260.37<700 km	Planet formation workshop	Tokyo, Japan	88 (36)	71.02	0.81	< 700 km	Funderpaire confined
Young Astronomers' Meet 2019 at Kodaikanal Solar Observatory Kodaikanal, India 57 (0) 21.26 0.37 < 700 km	International conference on Gravitation & Cosmology	Puniab India	196 (1)	141 75	0.72	< 500 km	
Modern Engineering Trends in Astronomy - 2019(META-2019)Bangalore, India193 (107)25.140.13< 700 kmMulti-wavelength Astronomy: Three years of AstroSat observationsBangalore, India84 (50)12.960.15< 300 km	Young Astronomers' Meet 2019 at Kodaikanal Solar Observatory	Kodaikanal India	57 (0)	21.26	0.37	< 700 km	
Multi-wavelength Astronomy: Three years of AstroSat observations Bangalore, India 175 (107) 22.14 0.15 < 100 km Multi-wavelength Astronomy: Three years of AstroSat observations Bangalore, India 84 (50) 12.96 0.15 < 300 km	Modern Engineering Trends in Astronomy - 2019(META-2019)	Bangalore India	193 (107)	25.14	0.13	< 700 km	
International Symposium on Extra - Solar Planets Bangalore, India 20 (5) 12.50 0.10 < 300 km 2019 ASBOC Annual Meeting Taichung Taiwan 176 (84) 11 23 0.06 < 500 km	Multi-wavelength Astronomy: Three years of AstroSat observations	Bangalore India	84 (50)	12.96	0.15	< 300 km	
$\frac{1}{2016} \frac{1}{280C} \frac{1}{280C} \frac{1}{280C} \frac{1}{280} $	International Symposium on Extra - Solar Planets	Bangalore India	20 (5)	10 08	1.00	< 300 km	
	2019 ASROC Annual Meeting	Taichung Taiwan	176 (84)	11.23	0.06	$< 500 \mathrm{km}$	

Table 2 continued.

Meeting name	Venue	Number of	Tot. travel	Emission per	Distance trav.	Note
C C	.	participants	emissions (tCO ₂ e)	participant (tCO ₂ e)	by train	
The Summer Summer Demonst Competing	Landan UK	surope	2.64	0.22	< 200 lum	Only origin countries many language
Supernova-Supernova Remnant Connection	Krouth Cormony	10 (4) 50 (2)	3.04	0.25	< 500 km	Only origin countries were known
Spectroscopy with SOFIA: new results & future opportunities	Kreuth, Germany	39(2)	39.14	0.00	< 500 km	
Monsters of the Universe: The Most Extreme Star Factories	Leiden, Netherlands	36 (0)	28.31	0.79	< 500 km	
Nucleosynthesis for a Life. Symposium in honour of Prof. Rotand Diem	Garching, Germany	100(30)	5.09	0.00	< 500 km	
12th IN LEGRAL conference	Geneva, Switzerland	166 (11)	115.14	0.69	< 500 km	
Formation of Stars and Massive clusters in Dwarf Galaxies over Cosmic Time	Leiden, Netherlands	45 (5)	44.54	0.99	< 500 km	Only origin contintents were known
Large survey with small telescopes	Bamberg, Germany	79 (13)	46.18	0.58	< 500 km	
20 years of FORS	Garching, Germany	12(2)	9.12	0.76	< 500 km	
Extreme Precision in Radial Velocity IV	Grindelwald, Switzerland	121 (0)	196.05	1.62	$< 300 \rm km$	
Galaxy Evolution in the Cosmic Web	Leiden, Netherlands	27 (3)	28.38	1.05	< 500 km	
The New Era of Multi-Messenger Astrophysics	Groningen, Netherlands	152 (28)	113.44	0.75	< 500 km	
Turbulence & magnetic fields	Helsinki, Finland	60 (8)	49.93	0.83	< 300 km	
SKA General Science Meeting	Macclesfield, UK	270 (64)	323.51	1.20	$< 300 \mathrm{km}$	
ESLAB symposium: the Gaia universe	Noordwijk, The Netherlands	142 (21)	67.15	0.47	$< 300 \mathrm{km}$	
Laboratory Astrophysics	Cambridge, UK	172 (17)	163.95	0.95	$< 300 \mathrm{km}$	
Delving into the neutron star crust (ICONS)	Amsterdam, Netherlands	38 (9)	47.29	1.24	$< 500 \mathrm{km}$	
PHAROS: multimessenger physics & neutron stars	Barcelona, Spain	176 (12)	123.52	0.70	$< 500 \mathrm{km}$	
Metals in Galaxies, Near and Far: Looking Ahead	Leiden, Netherlands	47 (3)	51.67	1.10	custom	flights from UK, 500km rule for other countries
Preparing for 4MOST	Garching, Germany	114 (27)	60.13	0.53	$< 500 \mathrm{km}$	
1st CTA Symposium	Bologna, Italy	275 (44)	249.32	0.91	$< 500 \mathrm{km}$	
ExoComets: Understanding the Composition of Planetary Building Blocks	Leiden, Netherlands	56 (10)	52.85	0.94	$< 700 \mathrm{km}$	
Herschel 10 years after launch	Madrid, Spain	69 (28)	34.95	0.51	$< 500 \mathrm{km}$	
Multi-messenger astro with SKA	Aveiro, Portugal	65 (20)	53.80	0.83	$< 500 \mathrm{km}$	
Meeting of Italian Astronomical Society	Rome, Italy	145 (58)	14.40	0.10	$< 500 \mathrm{km}$	
Exploring the Infrared Universe	Heraklion, Greece	164 (4)	271.48	1.66	$< 300 \mathrm{km}$	
Multi-spin galaxies	Asiago, Italy	32 (8)	30.41	0.95	$< 300 \mathrm{km}$	
Workshop on Polarization in Protoplanetary Disks and Jets	Sant Cugat, Spain	58 (7)	82.27	1.42	$< 500 \mathrm{km}$	
Star clusters: from the MilkyWay to the Early Universe	Bologna, Italy	204 (18)	308.42	1.51	$< 500 \mathrm{km}$	
From Interstellar medium to large scale structures	Stockholm, Sweden	73 (10)	71.29	0.98	$< 500 \mathrm{km}$	
Supernova remnants	Chania, Greece	193 (4)	401.31	2.08	< 300 km	
What matter(s) between galaxies: unraveling the knots in the Cosmic Web	Abbazia di Spineto, Italy	73 (0)	121.05	1.66	$< 500 \rm km$	
Linking the Milky Way and Nearby Galaxies: The ISM and Star Formation					2001	
from Cold Cores to Kpc Scales	Helsinki, Finland	99 (6)	165.1	1.67	$< 300 \mathrm{km}$	
Planetary Dynamics 2019	Heidelberg, Germany	67 (19)	62.01	0.93	< 500 km	
Partially ionised plasmas in astrophysics	Palma de Mallorca, Spain	53 (8)	57.00	1.08	< 300 km	
IAU Symposium 352: Uncovering early galaxy evolution in the ALMA and JWST era	Viana do Castelo, Portugal	172 (6)	312.88	1.82	< 300 km	Only origin countries were known
Joint conference of sub-regional EU astro committee	Sofia Bulgaria	56 (12)	4 38	0.08	< 500 km	
Zooming in on Star Formation	Nafplio Greece	116 (3)	174 47	1 50	< 300 km	
New perspectives on galactic magnetism	Newcastle upon Type UK	61 (6)	72 37	1.00	< 300 km	
Astrophysics of hot plasma in extended X-ray sources	Madrid Spain	78 (6)	110 34	1.19	< 500 km	
5th workshop of SCAR AAA Astronomy and Astrophysics from Antarctica	Courmaveur Italy	38 (0)	73.03	1.11	< 1000 km	
The cosmic web	Edinburgh UK	80 (14)	78.95	0.99	$< 500 \mathrm{km}$	
From Stars to Planets II. Connecting our understanding of star	Ediliburgii, OK	00(14)	10.55	0.77	< 500 km	
and planet formation	Gothenburg, Sweden	161 (14)	185.98	1.16	$< 300 \mathrm{km}$	
Starry	Leeds, UK	64 (7)	65.81	1.03	< 300 km	
9th meeting on hot subdwarfs	Hendaye, France	60 (0)	77.38	1.29	$< 500 {\rm km}$	
Astrochemistry: from nanometers to megaparsecs	Gothenburg, Sweden	79 (19)	65.02	0.82	< 500 km	
The new era of multi-messenger astrophysics	Groningen, Netherlands	149 (28)	110.01	0.74	< 300 km	
Ringberg Conference on Star-Planet connection	Kreuth, Germany	49 (0)	30.74	0.63	< 700 km	
RAS National Astronomy Meeting 2019	Lancaster UK	526 (121)	78.23	0.15	< 300 km	
Alpine Cosmology Workshon 2019 (ACW19)	La Berarde, France	20(1)	6.54	0.33	< 500 km	
From winds to jets: the role of outflows in compacts binaries	Amsterdam Netherlands	55 (15)	45 10	0.82	< 500 km	
The Beginnings and Ends of Double White Dwarfs	Conenhagen Denmark	72 (21)	95.43	1 33	< 500 km	
14th International Conference on Numerical Modeling	Copennagen, Denmalk	12 (21)	75.45	1.55	< 500 km	
of Space Plasma Flows (ASTRONUM-2019)	Paris, France	82 (7)	136.14	1.66	$< 300\rm km$	
14th hellenic astronomical conference	Volos Greece	130(2)	56 57	0.41	< 300 km	
Tracing Cosmic Evolution with Clusters of Galaxies IV	Sesto Italy	255 (1)	350.21	1 41	< 300 km	
Turbulence Structure Formation and Accretion in Protonlanetary	Sesto, mary	200 (1)	559.41	1.71	< 500 km	
Disks: Theory Observation and Experiment	Kreuth, Germany	60 (5)	61.83	1.03	$< 500 \mathrm{km}$	
Disks. Theory, Observation and Experiment						

Table 2 continued.

Meeting name	Venue	Number of	Tot. travel	Emission per	Distance trav.	Note
		participants	emissions (tCO ₂ e)	participant (tCO ₂ e)	by train	
IAU Symposium 355: The Realm of the Low Surface Brightness Universe	La Laguna, Spain	120 (15)	201.05	1.68	< 100 km	Only origin countries were known
Astronomy in Ukraina: from archaeoestronomy to high energy estronomysics	Kviv Ukraina	97 (15) 71 (45)	11 28	0.16	< 200 km	
XCalibur 2019 – High resolution X-ray spectroscopy as a probe of strong gravity	Kylv, Okraine	71 (45)	11.56	0.10	< 500 km	
and dark matter: From Hitomi to XRISM and beyond to Athena	Southampton, UK	74 (10)	75.32	1.02	$< 300 \mathrm{km}$	
A centenary of astrohovsical jets	Cheshire, UK	119 (17)	128.8	1.08	< 300 km	
Understanding cosmological observations	Benasque, Spain	65 (0)	73.32	1.13	< 500 km	
Nine Billion Years of Neutral Gas Evolution	Garching, Germany	84 (15)	151.08	1.80	$< 500 \mathrm{km}$	
Small galaxies, cosmis questions	Durham, UK	131 (20)	188.91	1.44	$< 300 \mathrm{km}$	
Quasars in crisis	Edinburgh, UK	69 (10)	86.40	1.25	$< 300 \mathrm{km}$	
Improving Image Fidelity on Astronomical Data: Radio Interferometer and Single-Dish Data Combination	Leiden, Netherlands	44 (7)	59.55	1.35	$<500\rm km$	
Extreme solar systems IV	Reykjavik, Iceland	583 (2)	928.25	1.59	$< 100 \mathrm{km}$	
Stars and their Variability, Observed from Space	Vienna, Austria	256 (30)	249.95	0.98	$< 500 \mathrm{km}$	Based on country of nationality
Stars on the Run II	Potsdam, Germany	70 (16)	43.03	0.61	$< 500 \rm km$	
Astro Hack Week 2019	Cambridge, UK	34 (4)	47.65	1.40	< 300 km	Participant list $\sim 40\%$ incomplete
49th Young European Radio Astronomers Conference	Dublin, Ireland	34 (7)	13.57	0.40	< 300 km	
Matera Oscura	Matera, Italy	139 (2)	145.76	1.05	< 500 km	
Physics & chemisty of interstellar medium	Avignon, France	123 (0)	135.71	1.10	< 500 km	
Views on interstellar medium in galaxies with ALMA	Bologna, Italy	116 (23)	105.43	0.91	< 500 km	
Astrophysics with GW detections	Barcelona, Spain Warsaw, Boland	45 (8)	51.01 40.80	1.15	< 300 km	
Universe of Binaries Binaries in the Universe	Telc. Czech Republic	38 (22) 88 (7)	91.54	1.04	< 300 km	
X-ray astronomy 2019	Bologna Italy	315 (35)	324.60	1.04	< 500 km	
A synontic view of the magellanic clouds	Garching Germany	104 (15)	165.45	1.59	< 500 km	
Stars as probes of first-star nucleosynthesis	Geneva, Switzerland	78 (18)	113.94	1.46	< 700 km	
Extremely big eves on the early universe	Rome. Italy	96 (21)	70.32	0.73	< 500 km	
Nuclear Physics in Astrophysics IX	Frankfurt, Germany	139 (51)	92.44	0.67	$< 500 \mathrm{km}$	Abstract book used for affiliations
IAU Astronomy Education Conference: Bridging Research & Practice	Garching, Germany	114 (4)	150.45	1.32	$< 500 \mathrm{km}$	Only origin countries were known
From Gas to stars	York, UK	82 (17)	81.30	1.00	$< 500 \mathrm{km}$	
The 3C extragalactic radio sky	Torino, Italy	98 (17)	106.36	1.09	$< 500 \mathrm{km}$	
The extragalactic explosive universe	Garching, Germany	102 (14)	88.14	0.86	$< 300 \mathrm{km}$	
Meeting of Astronomische Gesellschaft 2019	Stuttgart, Germany	219 (64)	48.25	0.22	$< 700 \mathrm{km}$	
Cosmology: the end of the beginning. Future prospects in cosmology, large scale structure and galaxy formation	Cambridge, UK	153 (56)	141.18	0.92	$<300\mathrm{km}$	
Statistics to the Stars and Back: Convincing Inference Across the Interdisciplinary Gap	Leiden, Netherlands	32 (25)	0.81	0.03	custom	Data available on how may trains and planes were taken
Rotation periods of cool stars	Potsdam, Germany	54 (14)	45.65	0.85	$< 500 \mathrm{km}$	
Crete III - Through dark lanes to new stars: Celebrating the career of Prof. Charles Lada	Crete, Greece	93 (3)	183.23	1.97	no train	
Bonn Gravity 2019	Bonn, Germany	74 (26)	61.93	0.84	< 500 km	
The time machine factory	Torino, Italy	82 (29)	39.78	0.49	$< 500 \rm km$	
YAGN19 - Young Astronomers on Galactic Nuclei	La Laguna, Spain	29 (5)	32.84	1.13	< 300 km	
The legacy of the gala-eso survey	Firenze, Italy	89 (18)	75.00	0.84	< 500 km	
38th International Meteor Conference	Croningon Nathorlanda	99 (11) 250 (67)	39.07	0.39	< 500 km	
ADASS Untangle the skein with Scorlet (LSST)	Bome Italy	350 (67)	438.34	1.25	< 200 km	
Cosmic Ray anisotropy workshop	Rome Italy	58 (16)	53.11	0.23	< 500 km	
RAS Specialist Discussion Meeting: Common envelope evolution and	Rome, nary	56 (10)	55.11	0.72	< 500 Kill	Particpants based on statement of organisers
post-common-envelope systems	London, UK	40 (13)	6.41	0.16	$< 300 \mathrm{km}$	assuming most participants are from UK
SKA-VLBI Key Science workshop	Cheshire, UK	65 (19)	86.59	1.33	$< 500 \mathrm{km}$	
ALMA2019: science results and cross-facility synergies	Cagliari, Italy	235 (3)	433.38	1.84	no train	
Historical Supernovae, Novae and Other Transient Events	Leiden, Netherlands	30 (5)	31.26	1.04	$< 700 \mathrm{km}$	
The Future of X-ray Timing	Amsterdam, Netherlands	123 (27)	122.49	1.00	$< 500 \mathrm{km}$	
First Galaxies, First Structures	Paris, France	60 (15)	57.17	0.95	$< 500 \mathrm{km}$	
EMU international meeting	Catania, Italy	27 (8)	40.26	1.49	< 500 km	
Revolutionary Spectroscopy of Today as a Springboard to Webb	Leiden, Netherlands	54 (4)	86.66	1.60	$< 700 \mathrm{km}$	
Voyage 2050 workshop - Shaping the European Space Agency's space science plan for 2035-2050	Madrid, Spain	262 (1)	159.43	0.61	< 300 km	Only origin continents were known
Scintillometry 2019	Bonn, Germany	63 (14)	90.16	1.43	< 500 km	
First Spanish Meeting on Galaxy Clusters	Madrid, Spain	41 (15)	16.16	0.39	< 500 km	
Lithium in the Universe: to Be or not to Be?	Rome, Italy	84 (6)	104.84	1.25	< 500 km	
The art of measuring galaxy physical properties	Milano, Italy	133 (8)	182.68	1.37	< 500 km	
PH I SIUS and AS I KUPH I SIUS OF CUSMIC RAYS	Saint Michel i Observatoire, France	40 (5)	15.02	0.38	< 500 km	
work rains in workshop for Planetary Incours observations	Leiden, Netherlands	30 (3) 35 (0)	12.02	1.44	< 500 km	
The Origins of Black Hole Mergers and Gravitational	Leiden, Netherlands	33 (9)	51.40	1.47	< 500 km	

Table 2 continued. [†]Origin cities used for US states are state capitols, except for the following states, for which we took the cities given in parentheses instead: Alabama (Tuscaloosa), Arizona (Tucson, Flagstaff), California (Los Angeles, San Diego, San Francisco), Connecticut (New Haven), Illinois (Chicago), Maryland (Baltimore), Michigan (Lansing, Ann Arbor), Minnesota (Minneapolis), Missouri (Saint Louis), New Mexico (Albuquerque, Socorro), New York (Albany, Ithaca, New York City, Rochester), Pennsylvania (Philadelphia, State College), South Carolina (Clemson, Columbia), Texas (Austin, Houston, Dallas), Virginia (Charlottesville, Lynchburg), Washington (Bellingham, Pullman, Seattle), and West Virginia (Morgantown). For states with more than two listed cities we divided the number of participants equally.

Maching name Venue orticipants methy and tricly of participant (CO ₂) Mathematic (Number of	Tot travel	Emission per	Distance trav	Note	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Meeting name	Venue	number of	amissions (tCO-a)	participant (tCO-a)	by train	Note	
Num etails PLATOPTANE: Supergine RLATOPARIEL Burdama, France 41 (1) 2.22 0.05 < VAMASTRO Marcials, France 41 (1) 2.23 0.04 <0.001	10th OPTICON Gaia Science Alerts Workshop	Cotonio Italy	54 (5)	37.67	0.70	< 500 km		
AddA STROPMassile frame $62,23$ 2.441 0.44 < 0.041 < 0.041 Iterstellin ExplorationNordevijk, Netherlands $90,(10)$ 0.23 0.235 0.922 < 300 kmIterstellin ExplorationNordevijk, Netherlands $90,(10)$ 0.43 < 300 km 0.01 orgin counties were knownIterstellin ExplorationNordevijk, Netherlands $90,(10)$ 1.32 0.41 < 300 kmNeurofeet stansing in the VTREITFrance, Iairy $1.90,(24)$ 1.32 0.41 < 500 kmNeurofeet stansing in the VTREITFrance, Iairy $1.62,(2)$ 0.448 < 0.01 < 500 kmAddA moningNeurofeet stansing on the virth IETNeurofeet stansing < 0.010 orgin counties were knownTotal Add moningNeurofeet stansing on the orgin NutreeNeurofeet stansing < 0.010 Total Count Add moningNeurofeet stansing < 0.010 < 0.010 Total Count Add moningNeurofeet stansing < 0.010 < 0.010 Total Count Add MoningNeurofeet stansing < 0.010 < 0.010 Total Count Add MoningNeurofeet stansing < 0.010 < 0.010 Total Count Add MoningNeurofeet stansing < 0.010 < 0.010 Total Count Add MoningNeurofeet stansing < 0.010 < 0.010 Total Count Add MoningNeurofeet stansing < 0.010 < 0.010 Total Count Add MoningNeurofeet stansing < 0.010 < 0.010 Total Count Add MoningNeurofeet stansing	Same stalier DL ATO/France: Supergies DL ATO/ADIEL	Catalila, Italy Bordeaux, Erance	J4 (J)	2 22	0.70	< 700 km		
$\begin{aligned} & \begin{tabular}{lllllllllllllllllllllllllllllllllll$	AOAASTRO	Marsaille France	62 (23)	28.81	0.05	< 500 km		
	TRAPPIST-1: Towards the Comparative Study of Temperate Terrestrial Worlds	Liège Relgium	90(23)	82.95	0.92	$< 300 \mathrm{km}$		
$ \begin{array}{c} \begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	Interstellar Exploration	Noordwijk Netherlands	30 (16)	0.43	0.01	custom	Data included how may trains and planes were taken	
	Exolimes V	Oxford UK	139(24)	192.2	1 38	< 300 km	Data included now may trains and planes were taken	
Science Juint Meeting Cancer, Switzerhand 1730 (23) 241.11 1.55 < 600 km Only origin countries were known Workford stending in the VLTPELT en Frenze, Italy 81 (24) 33.42 0.441 < 600 km	European Planetary Science Congress - AAS Division Planetary	Oxioid, OK	159 (24)	172.2	1.56	< 500 KIII		
Wordsing US Wordsing US States Protoc, Parts, P	Science Joint Meeting	Geneva, Switzerland	1730 (52)	2341.71	1.35	$< 500 \mathrm{km}$	Only origin countries were known	
UW Gain Witz Merkshop: Exoplanes in the era of Gain Perins, Pering 36 (10) 16.32 0.45 < 500 km EAS Meeting 2019 User, France H46.00 1014.80 0.71 < 500 km	Wavefront sensing in the VLT/ELT era	Firenze Italy	81 (24)	33.42	0.41	< 500 km		
Date Meeting 2019 Lym, Prance Herds (0) 0.718 $500 {\rm m}$ 233d AAS meeting Searaft, WA, USA 3396 (118) 3461.097 1.02 < 300 {\rm m} 234d LAS meeting Searaft, WA, USA 3396 (118) 3461.097 1.36 < 300 {\rm m} 23rd International Microlensing Conference Pasadema, CA, USA 82 (16) 133.90 (13.3 < 300 {\rm km} 23rd International Microlensing Conference Pasadema, CA, USA 93 (11) 12.29 1.32 < 300 {\rm km} Massively multiplexed spectroscopy with MSE Tucson, AZ, USA 93 (11) 12.29 1.32 < 300 {\rm km} During the Universe Los Angelse, CA, USA 28 (17) 15.24 1.53 < 300 {\rm km} Processources in the minerse Tucson, AZ, USA 28 (12) 34.41,7 1.23 < 300 {\rm km} Processources in the minerse Temps Ad, AZ, USA 27 (15) 56.20 ord main and the ord main and	MW-Gaia WG3 Workshop: Exoplanets in the era of Gaia	Porto, Portugal	36 (10)	16.32	0.45	< 500 km		
Source North & Center America Output & Conterning Output & Conterning Testing Gravity 2019 Scattle, WA, USA 336 (A18) 3461.97 1.02 300 (An 23d I dramational Microlensing Gravity 2019 Vancouver, Canada 117 (20) 159.70 1.36 < 300 km	EAS Meeting 2019	Lvon, France	1462 (0)	1034.80	0.71	$< 500 \mathrm{km}$		
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$		J · / · · · ·	North & C	entral America				
Testing Gravity 2019Vaccouver, Canada117 (2b)1597.01.46< < 200 km23rd International Microkensing ConferencePaadema, CA, USA82 (16)153.001.63< < <00 km	<00 km	233rd AAS meeting	Seattle, WA, USA	3396 (118)	3461.97	1.02	< 300 km	Only origin country and US states [†] were known
321 International Microlensing Conference Pasadem, CA, USA 82 (16) 133 00 1.63 < 200 km Data for 2019 conference not available, used 2017 puricipant list Massively multiplexed spectroscopy with MSE Teson, AZ, USA 93 (11) 122.9 1.32 < 200 km	Testing Gravity 2019	Vancouver, Canada	117 (26)	159.70	1.36	$< 300 \mathrm{km}$		
Extremply big eyes on the early universeLos Angeles, CA. USA 70 (17) 54.74 0.78 $< 300 {\rm km}$ Massively multiplecids spectroscopy with MSETusson, AZ, USA 91 (11) 12.29 1.32 $< 300 {\rm km}$ Into the Sharlight: The End of the Cosmic Dark AgesAgen, CO, USA 61 (0) 98.08 1.61 $< 300 {\rm km}$ Explore A K 2 Science Conference VGlendale, CA, USA 23 (0) 331.27 1.17 $< 300 {\rm km}$ HEAD 17 Di byvissional MeetingMonterey, CA, USA 37 (6) 38.22 1.05 no trialProcess sources in the universeTempe, AZ, USA 37 (6) 38.22 1.05 no trialNew quests in stellar attrophysics IVPuetro Vallarta, Maxico 109 (0) 41.48 1.30 $< 300 {\rm km}$ The Landscape O Space Astrophysics in the 2026 and BeyondPotomas, MD, USA 44 (2) 161.64 1.13 $< 300 {\rm km}$ The Death and Afterives of Space Astrophysics in the 2028 and BeyondPotomas, MD, USA 45 (12) 19.76 0.44 $< 300 {\rm km}$ The Death and Afterives of Space AstrophysicsPlenticon, Canada 45 (12) 19.76 0.44 $< 300 {\rm km}$ The Death and Constroped Mathemistry SystemsVictoria, Canada 144 (21) 192.35 1.43 $< 500 {\rm km}$ New Horizon in planetary systemsVictoria, Canada 192 (1) 192.35 1.43 $< 500 {\rm km}$ Conda Gravitational Awas Physics and AstrophysicsSana Baltamar, CA, USA 106 (10) 14.42	23rd International Microlensing Conference	Pasadena, CA, USA	82 (16)	133.90	1.63	$< 300 \mathrm{km}$	Data for 2019 conference not available, used 2017 participant list	
Massivery multipleced spectroscopy with MSE Tucson, AZ, USA 93 (1) 12.9 1.32 < 300 km Dusting the Universe Apen. OC, USA 61 (0) 98.08 1.61 < 300 km	Extremely big eyes on the early universe	Los Angeles CA USA	70 (17)	54 74	0.78	< 300 km	Data for 2017 conference not available, abea 2017 participant not	
Into the Starlight: The End of the Cosmic Dark AgesAgen, CO, USA61 (0)98.081.61< 400 kmDuring the UniverseTuscon, AZ, USA82 (7)125.241.53< 400 km	Massively multiplexed spectroscopy with MSE	Tucson AZ USA	93 (11)	122.9	1 32	< 300 km		
Dusting the Universe Tacson, AZ. USA 82 (7) 125 24 1.53 < 300 km Origin for one participant not retrievable Keyler & KZ. Science Conference V Glendlac, CA, USA 362 (7) 123 < 300 km	Into the Starlight: The End of the Cosmic Dark Ages	Aspen CO USA	61 (0)	98.08	1.61	< 300 km		
Krapler & K2 Science Conference VGlendale, CA, USA283 (7)331.271.17< 300 kmNoncomparison Mechanism ControlHEAD 17b Divisional MeetingMontery, CA, USA362 (25)44.7123 $300 km$ CHARA 2019Flagstaff, AZ, USA47 (5)36.200.77 $<500 km$ New quests in stellar astrophysics IVPerror Valiaria, Mexico100 (141.481.30 $<300 km$ New quests in stellar astrophysics IVPerror Valiaria, Mexico109 (0)141.481.30 $<300 km$ Better Stars, Better Planes, Exploiting the Stellar-Exophanetary SynergySanta Barban, CA, USA84 (47)30.84 $<301 km$ $<300 km$ The D-andcape of Space Astrophysics in the 2008 and BeyondPenricton, Canada45 (12)19.76 $<300 km$ $<300 km$ The Faure of Canadian Radio AstronomyPenricton, Canada45 (12)19.76 $<400 km$ $<400 km$ Stars 2019Havana, Cohoa31 (14) 81.751.54 $<300 km$ New Horizons in planetary systemsVactoria, Canada130 (38)142.881.00 $<300 km$ FOE Effy One Erg Supernova ConferenceRaleigh, NC, USA106 (44)67.80 $<300 km$ data with means of transportation were provided23019Monteria, Canada300 (38)112.831.69 $<300 km$ $<300 km$ FOE Effy One Erg Supernova ConferenceRaleigh, NC, USA75 (7)51.1970.68 $<300 km$ 2304 AAS meetingMonteria, Canada300 (38)1.16 (40)67.800.64 $<300 km$ <	Dusting the Universe	Tucson AZ USA	82 (7)	125.24	1 53	< 300 km	Origin for one participant not retrievable	
HEAD 17b Divisional Meeting Montrery, CA, USA 362 (25) 444 7 1.23 < 300 km CHARA 2019 Flagstaff, AZ, USA 47 (15) 36.30 0.77 < 500 km	Kepler & K2 Science Conference V	Glendale CA USA	283 (67)	331.27	1.17	< 300 km		
CHARA 2019Hagstaff, AZ, USA47 (15)36.200.77< 500 km P process sources in the universeTempe, AZ, USA47 (15)36.200.77< 500 km	HEAD 17th Divisional Meeting	Monterey CA USA	362 (25)	444 7	1.23	< 300 km		
Process sources in the universe Tempe, AZ, USA 37.60 38.82 1.05 no train New quests in stellar astrophysics IV Puerto Vallaria, Mexico 109 (0) 14.1.88 1.30 < 300 km	CHARA 2019	Flagstaff AZ USA	47 (15)	36.20	0.77	< 500 km		
New quests in stellar astrophysics IV Perro Vallara, Mexico 109 (0) 14 as 1.30 < 300 tm The Landscape of Space Astrophysics in the 2020s and Beyond Potomac, MD, USA 44 (47) 30.84 0.57 < 300 tm	r-process sources in the universe	Tempe AZ USA	37 (6)	38.82	1.05	no train		
The Landscape of Space Astrophysics in the 2020s and BeyondPotomac, MD, USA84 (47)30.840.37< 100 kmParticipants estimated from programmeBetter Stars, Better Planets: Exploiting the Stellar-Exoplanetary SynergySanta Barbara, CA, USA69 (6)98.781.43< 300 km	New quests in stellar astrophysics IV	Puerto Vallarta Mexico	109(0)	141 48	1.30	$< 300 \mathrm{km}$		
Better Stars, Better Planets: Exploiting the Stellar-Exoplanetary SynergySanta Barbara, CA, USA 69 (6) 98.78 1.43 < 300 kmThe Deaths and Afterlives of StarsBalimore, MD, USA 143 (28) 161.64 1.13 < 300 kmThe Future of Canadian Radio AstronomyPenticton, Canada 51 (12) 9.76 0.44 < 300 kmStars 2019Havana, Cuba 53 (14) 81.75 1.54 < 300 kmNew Horizons in planetary systemsVictoria, Canada 144 (21) 192.95 1.34 < 500 kmCanada-France-Hawaii Telescope 12th Users' MeetingMontreal, Canada 190 (30) 1.45 < 300 kmCondal-France-Hawaii Telescope 12th Users' MeetingMontreal, Canada 190 (30) 142.8 1.10 < 300 kmMemorial Symposium to hoor Riccardo GiacconiWashington DC, USA 116 (6) 056.38 1.69 < 300 kmOnly origin country and US states ¹ were known2019 Canadian Astronomical Society Annual MeetingMontreal, Canada 302 (85) 184.19 0.61 < 300 kmExploring the Galaxy and the Local Group with WFIRSTPasadena, CA, USA 79 (45) 38.69 0.49 < 300 kmSDSS-IVV Collaboration meetingEnsenada, Mexico 124 (37) 164.02 1.16 $.300$ kmAstroinformatics 2019Saate and CA, USA 59 (32) 61.60 1.04 < 300 kmSpace climate 7Canto Orford. Canada 76 (0) 19.58 $.57$ < 500 kmAstroinformatics 2019: Machin	The Landscape of Space Astrophysics in the 2020s and Beyond	Potomac MD USA	84 (47)	30.84	0.37	< 100 km	Participants estimated from programme	
The Dealts and Afterlives of Stars of Stars and Atterprives of Stars and Stars (1) and the set of Stars (1) and the set	Better Stars Better Planets: Exploiting the Stellar-Exonlanetary Synergy	Santa Barbara, CA, USA	69(6)	98.78	1.43	$< 300 \mathrm{km}$	r anteipanto estimatea nom programme	
The Future of Canadia Radio AstronomyPenticton, Canada45 (12)19, 760.44< 300 kmStars 2019Havana, Cuba53 (14)81, 751.54< 300 km	The Deaths and Afterlives of Stars	Baltimore MD USA	143 (28)	161 64	1.13	< 300 km		
Stars 2019Havana, Cuba53 (14)81.751.54< 300 kmNew Horizons in planetary systemsVictoria, Canada144 (21)192.951.34< 500 km	The Future of Canadian Radio Astronomy	Penticton Canada	45 (12)	19.76	0.44	< 300 km		
Description Interfact Gas 50 (1) 0.17.5 1.3.4 < 500 km New Horizons in planetary systems Victoria, Canada 144 (21) 192.95 1.3.4 < 500 km	Stars 2019	Havana Cuba	53 (14)	81.75	1 54	< 300 km		
The Norther France-Hawin Torleson with WorksonThe Control AusaThe Control Ausa	New Horizons in planetary systems	Victoria Canada	144(21)	192.95	1.34	$< 500 \mathrm{km}$		
In the function functionConstrained in the projectsConstrained in th	The New Fra of Gravitational-Wave Physics and Astrophysics	Santa Barbara CA USA	69 (6)	100.02	1.45	< 300 km		
FOLE Fifty-One Erg Supernova ConferenceRaleigh, NC, USA116 (16)16.281.69< 300 kmMemorial Symposium to honor Riccardo GiacconiWashington DC, USA106 (44)67.800.64customdata with means of transportation were provided234th AAS meetingSt. Louis, MO, USA753 (71)511.970.68< 300 km	Canada-France-Hawaii Telescope 12th Users' Meeting	Montreal Canada	130 (38)	142.8	1.45	< 300 km		
Memorial Symposium to honor Riceardo GiaconiWashington DC, USA106 (4)67.80106 (4)customdata with means of transportation were provided234H AAS meetingSt. Louis, MO, USA753 (71)511.970.68< 300 km	FOE Fifty-One Erg Supernova Conference	Raleigh NC USA	116 (16)	196.38	1.69	< 300 km		
234th AS meetingSt. Louis, MO, USA753 (71)511.970.68< 300 kmOnly origin country and US states ¹ were known2019 Canadian Astronomical Society Annual MeetingMontreal, Canada302 (85)184.190.61< 300 km	Memorial Symposium to honor Riccardo Giacconi	Washington DC_USA	106 (44)	67.80	0.64	custom	data with means of transportation were provided	
DiscretingDiscretingDiscretingDiscretingDiscretingDiscretingDiscretingDiscreting2019 Canadian Astronomical Society Annual MeetingMontreal, Canada302 (85)184.190.61< 300 km	234th AAS meeting	St Louis MO USA	753 (71)	511.97	0.68	< 300 km	Only origin country and US states [†] were known	
Exploring the Galaxy and the Local Group with WFIRSTPasadena, CA, USA79 (45)38.690.49< 300 kmGordon Conference on Origins of Solar SystemsSouth Hadley, MA, USA121 (4)136.501.13< 300 km	2019 Canadian Astronomical Society Annual Meeting	Montreal Canada	302 (85)	184 19	0.61	< 300 km	only origin country and ob states were known	
Include Local only latter for the Local only line Local only l	Exploring the Galaxy and the Local Group with WEIRST	Pasadena CA USA	79 (45)	38.69	0.49	< 300 km		
Astroinformatics 2019Pasadena, CA, USA59 (32)61.601.04< 300 kmSDSS-IV/V Collaboration meetingEnsenada, Mexico142 (37)164.021.16< 300 km	Gordon Conference on Origins of Solar Systems	South Hadley, MA, USA	121 (4)	136.50	1.13	$< 300 \mathrm{km}$		
SDSS-IV/V Collaboration meetingEnsenada, Mexico142 (37)164.021.16< 300 kmRadio/Millimeter Astrophysical Frontiers next decadeCharlottesville, VA, USA115 (41)61.410.53< 300 km	Astroinformatics 2019	Pasadena, CA, USA	59 (32)	61.60	1.04	$< 300 \mathrm{km}$		
Radio/Millimeter Astrophysical Frontiers next decadeCharlottesville, VA, USA115 (41)61.410.53< 300 kmKavli Summer Program In Astrophysics 2019: Machine Learning in the era of large astronomical surveysSanta Barbara, CA, USA35 (0)60.841.74< 300 km	SDSS-IV/V Collaboration meeting	Ensenada, Mexico	142 (37)	164.02	1.16	$< 300 \mathrm{km}$		
Kavli Summer Program In Astrophysics 2019: Machine Learning in the era of large astronomical surveysSanta Barbara, CA, USA35 (0)60.841.74< 300 kmSpace climate 7Canton Orford, Canada76 (0)119.581.57< 500 km	Radio/Millimeter Astrophysical Frontiers next decade	Charlottesville, VA, USA	115(41)	61.41	0.53	$< 300 \mathrm{km}$		
of large astronomical surveysSanta Barbara, CA, USA35 (0)60.841.74< 300 kmSpace climate 7Canton Orford, Canada76 (0)119.581.57< 500 km	Kavli Summer Program In Astrophysics 2019: Machine Learning in the era							
Space climate 7Canton Orford, Canada76 (0)119.581.57< 500 kmTASC5/KASC12 workshopCambridge, MA, USA118 (13)204.241.73< 300 km	of large astronomical surveys	Santa Barbara, CA, USA	35 (0)	60.84	1.74	$< 300 \mathrm{km}$		
TASC5/KASC12 workshopCambridge, MA, USA118 (13)204.241.73< 300 kmTESS Science Conference ICambridge, MA, USA118 (13)204.241.73< 300 km	Space climate 7	Canton Orford Canada	76 (0)	119 58	1.57	< 500 km		
TESS Science Conference ICambridge, MA, USA282 (92)316.031.12< 300 kmLong Wavelength Array Users MeetingAlbuquerque, NM, USA42 (14)15.010.36< 300 km	TASC5/KASC12 workshop	Cambridge MA USA	118 (13)	204 24	1.73	< 300 km		
Long Wavelength Array Users MeetingAlbuquerque, NM, USA42 (14)15.010.36< 300 kmMultiscale Phenomena in Plasma AstrophysicsSanta Barbara, CA, USA75 (1)134.141.79< 300 km	TESS Science Conference I	Cambridge MA USA	282 (92)	316.03	1.12	< 300 km		
Multiscale Phenomena in Plasma Astrophysics Santa Barbara, CA, USA 75 (1) 134.14 1.79 < 300 km	Long Wavelength Array Users Meeting	Albuquerque NM USA	42 (14)	15.01	0.36	< 300 km		
LSST 2019 Project and Community Workshop Tucson, AZ, USA 300 (106) 241.34 0.80 no train VISTA Variables in Via Lactea (VVV) 10th Science meeting. Hilo, HI, USA 25 (9) 53.28 2.13 < 100 km	Multiscale Phenomena in Plasma Astronhysics	Santa Barbara CA USA	75 (1)	134.14	1 79	< 300 km	Participants estimated from conference picture	
VISTA Variables in Via Lactea (VVV) 10th Science meeting. Hilo, HI, USA 25 (9) 53.28 2.13 < 100 km	LSST 2019 Project and Community Workshop	Tucson AZ USA	300 (106)	241 34	0.80	no train	r anteipanto estimatea nom contenence pretare	
	VISTA Variables in Via Lactea (VVV) 10th Science meeting	Hilo, HI, USA	25 (9)	53.28	2 13	< 100 km		
Hot-wiring the transient universe VI Evanston, IL USA 93 (19) 99.82 $1.07 < 300 \mathrm{km}$	Hot-wiring the transient universe VI	Evanston, IL, USA	93 (19)	99.82	1.07	< 300 km		
Non-Standard Cosmology Probes Aspen. CO. USA 40 (0) 76.32 191 no train	Non-Standard Cosmology Probes	Aspen, CO, USA	40 (0)	76.32	1 91	no train		
Connecting Micro and Macro Scales: Acceleration. Reconnection. and	Connecting Micro and Macro Scales: Acceleration Reconnection and	_r , co, con	(0)	.0.02		no uuni		
Dissipation in Astrophysical Plasmas Santa Barbara, CA, USA 76 (5) 129.00 1.70 < 300 km	Dissipation in Astrophysical Plasmas	Santa Barbara, CA, USA	76 (5)	129.00	1.70	$< 300 \mathrm{km}$		
The Cosmic Baryon Cycle: Impact on Galaxy Evolution Carlsbad, CA, USA 103 (12) 137.16 1.33 < 300 km	The Cosmic Barvon Cycle: Impact on Galaxy Evolution	Carlsbad, CA, USA	103 (12)	137.16	1.33	< 300 km		
Midwest workshop on Supernovae and transients Columbus, OH, USA 67 (24) 17.81 0.27 < 300 km	Midwest workshop on Supernovae and transients	Columbus, OH. USA	67 (24)	17.81	0.27	< 300 km		

Table 2 continued.

		Number of	Tot. travel	Emission per	Distance tray.	Note
Meeting name	Venue	participants	emissions (tCO ₂ e)	participant (tCO ₂ e)	by train	
Managing Follow-up Observations in the Era of ZTF and LSST	Pasadena, CA, USA	51 (11)	83.01	1.63	< 300 km	
Cosmic controversies	Chicago, IL, USA	281 (98)	204.87	0.73	$< 300 \mathrm{km}$	
Warm Ionized Medium in Galaxies Workshop	Green Bank, WV, USA	45 (6)	29.43	0.65	< 100 km	
The RR Lyrae and Cepheid Conference 2019: Frontiers of						
Classical Pulsators - Theory and Observations	Cloudcroft, NM, USA	75 (0)	165.59	2.21	no train	
IAU Symposium 357: White Dwarfs as probes of fundamental physics and						
tracers of planetary, stellar and galactic evolution	Hilo, HI, USA	93 (9)	250.40	2.69	no train	
Rocky Exoplanets in the era of JWST	Greenbelt, MD, USA	125 (70)	58.66	0.47	< 300 km	
The New Faces of Black Holes, 2019 JSI Workshop	Annapolis, MD, USA	70 (21)	45.05	0.64	< 300 km	Participants taken from picture, their origin from contributions
Subaru Telescope 20th Anniversary - Optical & Infrared Astronomy for the Next Decade	Waikoloa, HI, USA	240 (35)	453.88	1.89	$< 100 {\rm km}$	
Universality: Turbulence across vast scales	New York City, NY, USA	67 (30)	43.99	0.66	< 300 km	
Twenty Years of Science with Chandra	Boston, MA, USA	285 (154)	172.85	0.61	< 300 km	
Science at Low Frequencies VI	Tempe, AZ, USA	132 (17)	260.86	1.98	< 300 km	
Keck Wide-Field Imager Science Workshop	Pasadena, CA, USA	41 (13)	61.41	1.50	< 300 km	
TESS Data Workshop	Baltimore, MD, USA	80 (10)	72.87	0.91	< 100 km	No data on origin cities
Telluric Line Hack Week	New York City, NY, USA	44 (3)	43.62	0.99	< 300 km	6
Chesaneake Bay Area Exoplanet Meeting	Baltimore, MD, USA	60 (55)	0.66	0.01	$< 300 \mathrm{km}$	
Planet-Star Connections in the Era of TESS and Gaia	Santa Barbara, CA, USA	70 (8)	114.14	1.63	< 100 km	No data on origin cities
2019 Mid-American Regional Astrophysics Conference (MARAC)	Atchison, USA	50 (17)	6.30	0.13	$< 300 \mathrm{km}$	
(Oceania				
12th PHISCC workshop	Perth. Australia	80 (24)	167.17	2.09	< 300 km	
Linking galaxies from the enoch of initial star formation to today	Sydney, Australia	162 (57)	437.36	2.70	$< 500 \mathrm{km}$	Uncertainty for city origin within Australia
The life and death of starforming regions	Perth. Australia	91 (16)	306.4	3.37	$< 300 \mathrm{km}$	
LSST@Asia	Sydney Australia	102 (9)	257.60	2.53	< 300 km	
Barefoot reionization	Fitzroy Island, Australia	85 (0)	278.66	3.28	$< 300 \mathrm{km}$	
Great Barriers in Planet Formation	Palm Cove Australia	115 (0)	461.27	4 01	no train	
Astronomical Data Archives	Sydney Australia	42 (9)	86.80	2.07	< 300 km	
New Zealand Starlight Conference	Lake Tekano, New Zealand	132 (11)	142 37	1.08	< 300 km	
Exploiting Large Radio and mm Surveys to understand the ISM	Kingscliff Australia	22 (0)	14.12	0.64	< 300 km	
New Zealand Square Kilometre Array Forum	Auckland New Zealand	48 (24)	28.11	0.59	no train	
ACAMAR5 - Healesville	Melbourne Australia	82 (18)	139.89	1.71	no train	
Dynamical Models of Observed Galaxies	Sydney Australia	25 (15)	11.81	0.47	no train	
	Brishana Australia	223 (15)	147.41	0.63	no train	
Astronomical Data Archivas	Sydney Australia	42 (12)	88.48	2.11	no train	
Stors in Malbourne Workshop	Malbourna Australia	42 (12)	12.67	0.24	no train	
MAVIS Workshop	Sydney Australia	10(12)	2.07	0.34	no train	
A STPO 2D appual rateat	Bollorat Australia	05 (0)	54.26	0.17	< 200 km	
ASTRO 3D annual letteat	Sudney Australia	95 (0)	56.24	0.57	< 500 KIII	
ASTRO 5D science meeting	Sydney, Australia	South Americ	30.34	0.00	no trani	
The La Silla Observatory - inauguration to future	La Serena, Chile	73 (7)	168.06	2 30	< 500 km	
Oth Friends of Friends Meeting	Cordoba Argentina	133 (84)	84.80	2.50	< 500 km	
Workshop de Infraestructure Astronómice arcentine	Cordoba Argentina	82 (46)	16.14	0.04	< 200 km	
Precision spectroscopy workshop	Sao Paulo Prazil	42 (27)	14 54	0.19	< 500 km	
I I Constant Specific Scopy Workshop	Antofagosta Chile	43 (27) 220 (20)	247.57	0.54	< 500 km	
ino moung. Regional Laun-American	Antoragasta, Chile	550 (29)	247.37	0.75	< 000 kill	

Supplementary Table 3: List of all 42 schools with participant data. The number of participants given in parentheses are the amount of local participants, which travelled less than 200 km per round-trip.

		Number of	Tot travel	Emission per	Distance trav	Note
Meeting name	Venue	participants	emissions (tCO ₂ e)	participant (tCO ₂ e)	by train	1000
	Africa	putterputte		putterputt (te o ₂ e)	oj tium	
West African International Summer School						Estimated origin cities
for Young Astronomers	Abuja, Nigeria	70 (11)	32.65	0.47	$< 300 \mathrm{km}$	for students from Nigeria
Tot Total & Astronomicis	Asia					for students from Higoriu
Cosmogly – The Next Decade	Bangalore India	43 (7)	48.03	1 12	< 700 km	
The 1st Thai CTA workshop on Astronarticle Physics	Chiang Mai Thailand	74(8)	46.00	0.62	$< 300 \mathrm{km}$	
Astrowin10 - Winter School on Astronomy	Hyderabad India	64(11)	33.67	0.53	$< 500 \mathrm{km}$	
A COSPAR capacity building workshop	Punjah India	35 (1)	22.49	0.55	$< 300 \mathrm{km}$	
NABIT FACOA Summer Workshop on Astrostatistics & Astroinformatics	Chiang Mei, Thailand	54 (7)	36.77	0.68	$< 300 \mathrm{km}$	
IFAS5 Astronomy summer school Spectroscopy & Spectrographs	Pupe India	34(7)	13 70	0.00	< 200 km	
Pagional summar school on space sciences	Puurakan Armania	31(14) 23(15)	5.79	0.44	$< 300 \mathrm{km}$	
lst Melevsien VI PI Workshon	Byulakali, Alliellia	23(13)	28 27	0.24	< 200 km	
A DOTTO S LA 1/W LA LA CARACTERIA DE LA CARACTERIA DE LA 1/W LA LA CARACTERIA DE LA 1/W LA LA CARACTERIA DE LA 1	Kuala Lumpur, Malaysia	54 (29) 100 (25)	28.37	0.55	< 300 km	
APC IP School/ workshop on Gravitational-wave Cosmology	Lab Ladia	100 (33)	81.84 56.79	0.82	< 300 km	
A2 11 cm cm l 1 cm l 2		50(0)	30.78	1.14	< 300 km	
42nd International school for Young Astronomers	Kunming, China	64 (23)	44.41	0.69	< 1000 km	
8th IIS1 Astronomy and Astrophysics School - 2019	I niruvanantnapuram, India	47(1)	17.08	0.36	$< 500 {\rm km}$	
	Europe	20.(0)	10.60	1.00	×	
The Milky Way in the Gaia Era	Saas Fee, Switzerland	38 (0)	48.68	1.28	$< 500 {\rm km}$	
Gravitational wave open data workshop	Paris, France	54 (18)	30.50	0.56	$< 500 \mathrm{km}$	
Multiple approaches to plasma physics	Les Houches, France	70(1)	57.28	0.82	$< 700 \mathrm{km}$	
Advanced school on exoplanetary science	Salerno, Italy	86 (5)	72.80	0.85	$< 500 \mathrm{km}$	
Cosmic explosions 2019	Cargese, France	54 (0)	51.85	0.96	$< 100 \mathrm{km}$	Only country of origin known
SPACE ASTROMETRY FOR ASTROPHYSICS	L'Aquila, Italy	55 (1)	70.70	1.29	$< 500 \mathrm{km}$	
Cracow school of Theoretical physics	Zakopane, Poland	69 (44)	26.43	0.38	$< 500 \mathrm{km}$	
Torun Astrophysics, Spectroscopy and Quantum Chemistry school	Torun, Poland	60 (19)	25.20	0.42	$< 500 \mathrm{km}$	
Artificial Intelligence in Astronomy	Garching, Germany	122 (28)	101.80	0.83	$< 500 \mathrm{km}$	
Summer school on protoplanetary disks	Copenhagen, Denmark	53 (15)	42.62	0.80	$< 500 \mathrm{km}$	
IRAM 30m summer school	Granada, Spain	43 (4)	39.43	0.92	$< 500 \mathrm{km}$	
Heidelberg summer school: Instrumentation for	Haidalbarg Carmony	51 (10)	41.12	0.91	< 500 lm	
Ground-based Optical & Infrared Astronomy	Heidelberg, Germany	51 (10)	41.15	0.81	< 500 km	
Torun summer school: Polarimetry as	Tamm Daland	24 (0)	12.04	0.29	< 500 1	
diagnostic tool in astronomy	Iorun, Poland	34 (9)	13.04	0.38	$< 500 {\rm km}$	
School of Statistics for Astrophysics 2019:		20 (5)	0.71	0.14	- 5001	
Variability and Time Series Analysis	Autrans, France	20(5)	2.71	0.14	$< 500 {\rm km}$	
1st IAA-CSIC Severo Ochoa School on		45 (20)	25.00	0.50	5001	
Statistics, Data Mining and Machine Learning	Granada, Spain	45 (20)	25.89	0.58	$< 500 \mathrm{km}$	
NYRIA workshop 2019	Lisbon, Portugal	19 (3)	15.14	0.80	< 300 km	
CNRS thematic school of astroparticle physics	Manosque, France	40 (5)	15.02	0.38	< 500 km	
Astroparticle School ECAP	Obertrubach, Germany	41 (1)	9.62	0.23	< 700 km	
	North & Centra	1 America				
Multiscale Modeling of Astrophysical and Space Plasmas	New York City USA	41 (1)	57.61	1 41	< 300 km	
2019 Sagan Exonlanet Summer Workshon	Pasadena California USA	35 (12)	31.24	0.89	< 100 km	
GROWTH astronomy school	San Diego USA	149 (62)	102.15	0.69	< 300 km	
CfAO Summer school on adaptive optics	Santa Cruz, California, USA	48 (9)	60.10	1.25	$< 300 \mathrm{km}$	
Summer school on statistics in Astronomy	State College Pennsylvania USA	50(10)	51 38	1.03	$< 500 \mathrm{km}$	
Formi Summer School	Lawas Dalawara USA	28 (0)	27.48	1.05	< 200 km	Only country of origin known
	Lewes, Delawale, USA	20(0)	57.40	1.34	< 500 KIII	Only country of origin known
ASTRO 2D East Coast uniting retract	Sudnay Australia	a 10 (15)	0.02	0.05	no troin	
ASTRO 3D East Coast writing vorkshop	Syuney, Australia	19 (13)	0.95	0.05	no train	Domoto attendente ovoluitat
CASS Badia Astronomy School 2010	Vanuerra, Australia	21 (14) 57 (1)	1.13	0.05	no train	Remote attendants excluded
CA55 Radio Astronomy School 2019	Ivairaori, Australia		33.33	0.39	< 500 km	
	South Ame	erica	100.4	1.00	5001	
First Light	Sao Paulo, Brazil	117 (26)	198.4	1.98	$< 500 \rm km$	
La plata international school	La Plata, Argentina	57 (24)	54.2	0.95	< 300 km	

Supplementary Table 4: List of conferences lacking data on the origin cities, countries or continents for the participants. If not noted otherwise, the average participant number for each continent was used depending on the conference location. We use the continent-specific mean emissions per participant to estimate the total amount of travel-related GHG emission for each meeting (see Table 1).

Name	Venue	Number of participants	Tot. travel emissions (tCO ₂ e)	Note
	Asia			
Baryons in Galaxies and Beyond	Teheran, Iran	80	88.0	Participant number estimated from picture
Gamma-Ray Bursts and Related Astrophysics in Multi-Messenger Era	Nanjing, China	91	100.1	-
14th International Astronomical Consortium for High Energy Calibration meeting	g Kanagawa, Japan	58	63.8	Participant number estimated from programme and picture
Atomic Structure and Oscillator Strengths for astrophysical and fusion plasma research	Shanghai, China	91	100.1	
15th International Symposium on Origin of Matter and Evolution of Galaxies	Kyoto, Japan	91	100.1	
Astrophysical Dynamics	Shanghai, China	91	100.1	
Progenitors of Type Ia supernovae	Lijiang, China	100	110.0	Organisers report ~ 100 participants
Galaxy Angular Momentum Alignment 2019	Shanghai, China Talwa, Japan	91	100.1	
In the Spirit of Lyot 2019 Planet2/RESCEU Symposium: From Protonlanetary Disks through	Tokyo, Japan	91	100.1	
Planetary System Architecture to Planetary Atmospheres and Habitability	Okinawa, Japan	91	100.1	
IRIS 10 @ IIA and CHRIST	Bangalore, India	91	100.1	
Thermal Models in Planetary Science III	Budapest, Hungary	45	45.0	Participant number estimated from programme
Enabling LISA Science Exploitation	Leiden, Netherlands	40	40.0	Participant number based on typical size of
MOSAIC 2019: Science and Surveys with the ELT Multi-Object Spectrograph	Heidelberg, Germany	50	50.0	Participant number guessed
UK Exoplanet Community Meeting	London, UK	103	103.0	
Electron-Capture-Initiated Stellar Collapse	Leiden, Netherlands	40	40.0	Participant number based on typical size of Lorentz-Center workshops
Light in the suburbs: structure and chemo-dynamics of galaxy halos	Sexten, Italy	103	103.0	F*
Supermassive Black Holes: environment and evolution	Corfu Town, Greece	103	103.0	
Stellar Hydro Days V	Exeter, UK	103	103.0	
Feedback and its Role in Galaxy Formation	Spetses, Greece	100	100.0	Organisers report ~ 100 participants
CosmoCruise2019: From the Early to the Late Universe	Venice, Italy	103	103.0	
Understanding the nearby star forming Universe with JWST	Courmayeur, Italy	50	50.0	Participant number estimated from picture
Irish National Astronomy Meeting 2019	Armagh, UK	103	103.0	
The Pleiades and friends: stellar associations in the Gaia era	A Coruña, Spain	103	103.0	
6th Workshop on Robotic Autonomous Observatories	Torremolinos, Spain	103	103.0	
Interaction of Stars with their Environment 2019	Budapest, Hungary	30	30.0	Participant number guessed
PLATO atmospheres workshop	Werminele UK	40	40.0	Participant number guessed
Frank Workshop - Single, Shallow, and Strange transits	Budapast Hungary	105	70.0	Max participants - 70
South Fast Exoplanet Meetings	London UK	30	30.0	Participant number guessed
South East Exoplance Meetings	North & Central America	50	50.0	Tattopant number gaessed
Midwest Magnetic Fields Workshop 2019	Madison, WI, USA	40	48.0	Participant number estimated from programme
MMT Observatory 40th Anniversary Symposium	Tucson, AZ, USA	110	132.0	
50th Annual Division on Dynamic Astronomy Meeting	Boulder, CO, USA	110	132.0	
Stellar Magnetism: A Celebration of the Contributions of J.D. Landstreet	London, Canada	40	48.0	Participant number estimated from proceedings
Python in Astronomy 2019	Baltimore, MD, USA	50	60.0	Participant number estimated from picture
Understanding Dust 30 Years After CCM	Boulder, CO, USA	50	60.0	Participant number guessed
Astrophysics in the LIGO/Virgo Era	Aspen, CO, USA	20	24.0	Participant number guessed
258th ACS National Meeting, Symposium on Water in the Universe	San Diego, CA, USA	45	54.0	Participant number guessed
SciCoder Workshop	Kampala, HI, USA	20	24.0	Participant number guessed
2019 AAV SO 108in Annual Meeting NASA Hubble Fellows Program Symposium	Washington DC_USA	80 24	90.0	Participant number guessed
	Washington DC, 05A	24	20.0	Participant number guessed from two
Brown Dwarf to Exoplanet Connection III	Newark, DE, USA	45 210	54.0 252.0	previous meetings
Emerging Researchers in Exonanet Science	Ithaca NY USA	60	72.0	Participant number guessed
WFIRST Exoplanet Imaging Data Challenge	New York City, NY, USA	20	24.0	Participant number guessed
	Oceania	20		r
ANITA workshop and astroinformatics 2019	Melbourne, Australia	80	26.5	Participant number estimated from picture
ASTRO 3D writing retreat	Coogee, NSW, Australia	19	30.4	Participant number guessed
	South America			
II Workshop Chemical Abundances in Gaseous Nebulae: Open Problems in Nebular Astrophysics	Sao Jose dos Campos, Brazil	60	72.0	Participant number estimated from picture
IAU Symposium 354 - Solar and Stellar Magnetic Fields: Origins and Manifestations	Copiapo, Chile	70	84.0	Participant number estimated from proceedings

Supplementary Table 5: List of schools lacking data on the origin cities, countries or continents for the participants. If not noted otherwise, the average participant number for each continent was used depending on the conference location. We use the continent-specific mean emissions per participant to estimate the total amount of travel-related GHG emissions for each meeting (see Table 1 in the main paper manuscript).

			Tot. travel	
Name	Venue	Number of	emissions	Note
		Participants	(tCO ₂ e)	
	Asia			
IIA Summer Programme	Kodaikanal, India	38	24.70	Number of participants known, assumed mainly Indian origin
Kodaikanal winter school on solar physics	Kodaikanal, India	40	26.00	Maximum number of participants known
NARIT-IOGS Optical Design Summer School 2019	Chiang Mai, Thailand	25	16.25	Used participant numbers from similar school in 2016
"BASIS" Foundation Summer School 2019: Evolution of Galaxies and Stars	Sotchi, Russia	25	16.25	Participant number guessed from programme
Particles and Cosmology: the 16th Baksan School on Astroparticle Physics	Baksan Valley, Kabardino-Balkaria, Russian Federation	25	16.25	Participant number estimated from picture
	Europe			
Ecole Evry Schatzman du PNPS - Interactions étoile - planètes	France	54	37.26	
Computational Fluid Dynamics in Astrophysics	La Laguna, Tenerife, Spain	65	44.85	Participant number estimated from picture
XIII Tonale Winter School on Cosmology	Tonale, Italy	45	31.05	Organisers reported participant numbers and continent of origin
Light Anti-Nuclei as a Probe for New Physics	Netherlands	29	37.26	Participant number listed in meeting report
St Andrews Monte Carlo Radiation Hydrodynamics Summer School	St. Andrews, UK	54	37.26	
4th OBSPM/LAM Summer School Galaxy Formation and Evolution in a Cosmological Context	Spetses, Greece	30	30.70	Maximum number of participants taken from previous school
Advancing Theoretical Astrophysics	Amsterdam, Netherlands	54	37.26	
Exoclimes Simulation Platform (ESP) Inaugural Summer School	Guarda Val, Switzerland	54	37.26	