

## ORIGINS OF THE EXPANDING UNIVERSE: 1912-1932

*COVER ILLUSTRATION:*

Vesto Melvin Slipher (1909)

Image courtesy of The Lowell Observatory Archives.

ASTRONOMICAL SOCIETY OF THE PACIFIC  
CONFERENCE SERIES

A SERIES OF BOOKS ON RECENT DEVELOPMENTS IN ASTRONOMY AND ASTROPHYSICS

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**Volume 471**

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MS 179, Utah Valley University, 800 W. University Parkway, Orem, Utah 84058-5999  
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**Volume 471**

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**ORIGINS OF THE EXPANDING UNIVERSE: 1912-1932**

Proceedings of a Conference held at  
Flagstaff, Arizona, USA  
13-15 September 2012

Edited by

**Michael J. Way**

*NASA Goddard Institute for Space Studies, New York, New York, USA*

**Deidre Hunter**

*Lowell Observatory, Flagstaff, Arizona, USA*



SAN FRANCISCO

ASTRONOMICAL SOCIETY OF THE PACIFIC

390 Ashton Avenue  
San Francisco, California, 94112-1722, USA

Phone: 415-337-1100

Fax: 415-337-5205

E-mail: [service@astrosociety.org](mailto:service@astrosociety.org)

Web site: [www.astrosociety.org](http://www.astrosociety.org)

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First Edition

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ASP Conference Series

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ISBN: 978-1-58381-826-8  
e-book ISBN: 978-1-58381-827-5

Library of Congress (LOC) Cataloging in Publication (CIP) Data:

Main entry under title

Library of Congress Control Number (LCCN): 2013931137

Printed in the United States of America by Sheridan Books, Ann Arbor, Michigan.

This book is printed on acid-free paper.

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*W. G. Tift*





# Preface

## 1. Background

On the 17th of September 1912 Vesto Melvin Slipher (known to family and colleagues alike as “VM”) exposed the plate that was to contain the first measured Doppler shift of a spiral nebula. This was a momentous event at the time and even more so in hindsight. Since William Huggins of London first measured the Doppler shift of a star, Julius Scheiner of Potsdam and others had been attempting to measure this shift in the lines of spiral nebulae. Slipher’s observational work alone was arduous as he himself points out in his 1913 publication: “The first of the recent plates was exposed for 6 hours and 50 minutes, on September 17, 1912, . . .” Making the Brashear spectrograph useful for this type of observation was a multi-year struggle, but as described by Slipher, the observations themselves were also long and difficult. The contributions in this book by Laird Thompson, Joseph Tenn, Kevin Schindler and Robert Smith explain in detail how Slipher and Lowell Observatory made these discoveries possible. They also explain the difficulties that Lowell Observatory faced within the community to gain acceptance as a peer that could produce accurate, reliable, and convincing discoveries.

The conference that inspired this book was organized to coincide with Slipher’s observation 100 years ago in September 1912. Several years ago, in preparing a university lecture for undergraduate non-science majors on the history of the discovery of the expanding universe, I became aware of the complex history of this discovery. In fact I had no idea how complex it was even after several months of study in my spare time. After another year of study I began to give colloquia on this topic and through those I learned a great deal more from my audiences. So while many of our astronomy colleagues remain uninformed about much of this history, there are a number who are very aware of the events described in this book.

Regardless, it was clear that a number of important contributors to this story were nearly forgotten or, perhaps even worse, misunderstood. First among those was V. M. Slipher. In the summer of 2011 I realized that one way to rectify this injustice would be to host a conference in his honor on the anniversary of his first successful observation.

The initial preparations for this conference took place in October 2011 with Joseph Patterson of Columbia University and Matthew Stanley of New York University. Early moral support was given by John Peacock of the University of Edinburgh, Harry Nussbaumer of ETH Zürich and Hilmar Duerbeck of the University of Muenster.

Sixty-five people attended this conference September 13-15, 2012 in Flagstaff, Arizona, USA, home of Lowell Observatory and V. M. Slipher. The conference brought together astronomers, historians, and interested lay people to explore the beginnings and trajectories of the concept of the expanding universe. It is a testament to the interest of this subject that the gathering was an eclectic mixture of people from many backgrounds and from all over the world.

This project could not have taken place without the support and strenuous efforts of my co-editor Deidre Hunter who also served as the Local Organizing Committee Chair. Her efforts along with those of the support staff at Lowell Observatory made the conference and visit to Lowell Observatory memorable for all of the participants. Joseph Marcus also offered vital support to make this book possible.

## 2. Book Organization

In order to maintain the highest quality possible the reader should be made aware that, unlike many other conference proceedings, all of the contributions to this volume have been refereed by a *minimum* of two outside reviewers. Every chapter was also refereed and reviewed by both editors. To give a flavor of what such reviews and the required organization entail as of 17 January 2013 (as this publication is being submitted to the *Astronomical Society of the Pacific Conference Series*) my own e-mail folder for this conference and book contains over 2700 messages. Let those who might contemplate a similar project in the future beware.

The book is divided into several parts:

1. Redshifts and the Growth of Cosmology
2. Discovery and Fame
3. Instrumentation and Observational Techniques
4. Historical Context
5. Personal Reflections
6. Modern Redshifts and Cosmology

### 2.1. Redshifts and the Growth of Cosmology

These chapters explore the key roles that V. M. Slipher, A. S. Eddington, W. de Sitter, A. Friedman, and G. Lemaître played in the development and propagation of static and dynamic models of the universe. Important contributions by L. Silberstein, K. Lundmark and G. Strömberg toward the search for a relationship between the distances and redshifts of globular clusters and spiral nebulae are also discussed.

### 2.2. Discovery and Fame

A great deal has been written in recent years about who “discovered” the expanding universe. These four chapters go into detail regarding the roles that V. M. Slipher, A. Friedman and a large number of other members of the astronomical community played in the discovery of an expanding universe. The question of who should get credit and why is explored in depth, as well as why those who should have received credit for their contributions did not.

### 2.3. Instrumentation and Observational Techniques

Three of these chapters investigate the challenges that Lowell Observatory and its staff faced as they acquired and later attempted to fully utilize the spectrograph that made V. M. Slipher’s Doppler shift discoveries possible. All chapters delve into the issue of how Lowell Observatory promoted (or did not) their investigations and the impact that had on its staff and on how other institutions viewed Lowell Observatory.

### 2.4. Historical Context

The development of a model of the universe that contained more than our solar system and galaxy has a much longer and complex history than this conference could hope to discuss. However, one chapter reaches back to the 17th century and presents the discoveries in the early 1900s in a broader context. The contribution of Henry Norris Russell to this debate is explored in several chapters, while the complex personal and professional lives of V. M. Slipher and G. Lemaître are discussed.

## **2.5. Personal Overviews**

The conference was fortunate to have several guests who knew V. M. Slipher and some of those that worked with him. Slipher's grandson A. Slipher reminisced about his grandfather at the conference dinner, providing some insight into his character. W. Putnam, grand-nephew of Percival Lowell and current Sole Trustee of Lowell Observatory, discussed Slipher's life and a missed opportunity to promote his name. Other chapters describe a visit by E. Hubble to Flagstaff and the curious lack of discussions about science and the inspiration of H. Curtis, a contemporary of Slipher's and important player in the debate over the nature of spiral nebulae.

## **2.6. Modern Redshifts and Cosmology**

V. M. Slipher's desire to measure the redshifts of spiral nebulae was the beginning of a century of incredible progress in collecting, analyzing and fitting such data into a variety of cosmological models. In this chapter our progress in collecting redshifts in the modern era is discussed, but also the problems that these data caused for the current standard cosmological model. Alternative scenarios to the Big Bang model of Friedman and Lemaître are discussed, as well as some of the modifications to the Big Bang model that were needed to keep it consistent with the latest discoveries.

Michael J. Way



## Participants

Fred Adams, Department of Physics, University of Michigan, Ann Arbor, Michigan, USA < fca@umich.edu >

Daniel Armstrong, School of Communication and Creative Arts, Deakin University and Royal Melbourne Institute of Technology, Melbourne, Victoria, Australia < daniel.armstrong@deakin.edu.au >

Lucía Ayala, University of Applied Arts, Vienna, Austria < lucia@luayas.net >

Drew Barringer, . . . , Flagstaff, Arizona, USA < dnbcc@aol.com >

Antoinette Beiser, Lowell Observatory, Flagstaff, Arizona, USA < asb@lowell.edu >

Ari Belenkiy, Mathematics Department, British Columbia Institute of Technology, Burnaby, British Columbia, Canada < ari.belenkiy@gmail.com >

Bob Birket, . . . , Mesa, Arizona, USA < bobscddimaging@yahoo.com >

Anita Bjorklund, . . . , Flagstaff, Arizona, USA < ambjork@aol.com >

Paul Bjorklund, . . . , Flagstaff, Arizona, USA < ambjork@aol.com >

Greg Bothun, Department of Physics, University of Oregon, Eugene, Oregon, USA < dkmatter@uoregon.edu >

Klaus Brasch, . . . , Flagstaff, Arizona, USA < krbrasch@earthlink.net >

John W. Briggs, HUT Observatory, Eagle, Colorado, USA < john.w.briggs@gmail.com >

Joyce Browning, . . . , Flagstaff, Arizona, USA < jrbrowning2010@gmail.com >

Tom Chabin, Arizona State Legislature, Phoenix, Arizona, USA < RAndrews@azleg.gov >

G. Kent Colbath, GKC Geoscience, Flagstaff, Arizona, USA < gkcgeoscience@gmail.com >

Peter Coles, School of Physics and Astronomy, Cardiff University, Cardiff, United Kingdom < Peter.Coles@astro.cf.ac.uk >

Frederick Dennstedt, . . . , Flagstaff, Arizona, USA < Fdennstedt@gmail.com >

Luisa Dennstedt, . . . , Flagstaff, Arizona, USA < Fdennstedt@gmail.com >

David DeVorkin, Smithsonian Institution, Washington, D. C., USA < DeVorkinD@si.edu >

Sue Durling, . . . , Flagstaff, Arizona, USA < sdurling@juno.com >

Richard Ellis, Department of Astronomy, California Institute of Astronomy, Pasadena, California, USA < rse@astro.caltech.edu >

John Evelan, . . . , Mesa, Arizona, USA < jeveni@yahoo.com >

John Farrell, Forbes Media, Newton, Massachusetts, USA < johnwfarrell@gmail.com >

Joseph Foy, Barrett Honors College, Arizona State University, Tempe, Arizona, USA < jpfoy@asu.edu >

Matt Francis, Prescott Observatory, Prescott, Arizona, USA < matt@prescottobservatory.com >

- Ken Freeman, Mt. Stromlo Observatory, Australian National University, Canberra, ACT, Australia < kcf@mso.anu.edu.au >
- Owen Gingerich, Departments of Astronomy and History of Science, Harvard University, Cambridge, Massachusetts, USA < ginger@cfa.harvard.edu >
- Karl Glazebrook, Centre for Astrophysics & Supercomputing, Swinburne University of Technology, Hawthorn, Victoria, Australia < karl@astro.swin.edu.au >
- Jeff Hall, Lowell Observatory, Flagstaff, Arizona, USA < jch@lowell.edu >
- Scott Harger, . . . , Flagstaff, Arizona, USA < cannonbone@msn.com >
- Mary Kay Hemenway, Department of Astronomy, University of Texas, Austin, Texas, USA < marykay@astro.as.utexas.edu >
- Deidre Hunter, Lowell Observatory, Flagstaff, Arizona, USA < dah@lowell.edu >
- Chris Impey, Steward Observatory, University of Arizona, Tucson, Arizona, USA < cimpey@as.arizona.edu >
- Emir Karamehmetoglu, Department of Astronomy, Columbia University, New York, New York, USA < ek2660@columbia.edu >
- Don Lago, . . . , Flagstaff, Arizona, USA < drlago@infomagic.net >
- Bruce Lieberman, . . . , Carlsbad, California, USA < bruce.lieberman@yahoo.com >
- Joseph Marcus, . . . , St. Louis, Missouri, USA < josephnmarcus@gmail.com >
- Nathan Mamo, St. Gall Cathloic Church, Gardnerville, Nevada, USA < geographa@gmail.com >
- Philip Massey, Lowell Observatory, Flagstaff, Arizona, USA < massey@lowell.edu >
- Bill McDonald, Prescott Astronomy Club, Prescott, Arizona, USA < skyhighaz@cabelone.net >
- Robert Morgan, Department of Astronomy, Arizona State University, Tempe, Arizona, USA < robert.j.morgan@asu.edu >
- Harry Nussbaumer, Institute of Astronomy, ETH Zürich, Zürich, Switzerland < nussbaumer@astro.phys.ethz.ch >
- Cormac O’Raifeartaigh, Waterford Institute of Technology, Waterford, Ireland < coraifeartaigh@wit.ie >
- Andy Odell, . . . , Flagstaff, Arizona, USA < Andy.Odell@nau.edu >
- Joe Patterson, Department of Astronomy, Columbia University, New York, New York, USA < jop@astro.columbia.edu >
- John Peacock, Institute for Astronomy, University of Edinburgh, Edinburgh, United Kingdom < jap@roe.ac.uk >
- William Putnam, III, Lowell Observatory, Flagstaff, Arizona, USA < putnam@lowell.edu >
- John Radway, . . . , Wickenburg, Arizona, USA < kiawe1@mac.com >
- James Roberts, . . . , Phoenix, Arizona, USA < jimroberts@robertsjones.com >
- Julio Saucedo Morales, Área de Astronomía, Universidad de Sonora, Hermosillo, Sonora, Mexico < jsaucedo@cifus.uson.mx >

- Kevin Schindler, Lowell Observatory, Flagstaff, Arizona, USA < kevin@lowell.edu >
- Cynthia Schnitzer, Prescott Astronomy Club, Prescott, Arizona, USA  
< schnitz@cableone.net >
- Russell Schnitzer, Prescott Astronomy Club, Prescott, Arizona, USA  
< schnitz@cableone.net >
- Allan Slipher, . . . , Port Townsend, Washington, USA < allanslipher@hotmail.com >
- Geoffrey Slipher, US Army Research Laboratory, Baltimore, Maryland, USA  
< slipherg@gmail.com >
- Robert Smith, Department of History and Classics, University of Alberta, Edmonton,  
Alberta, Canada < rwsmith@ualberta.ca >
- Dava Sobel, . . . , East Hampton, New York, USA < ds23@optonline.net >
- Matthew Stanley, Gallatin School of Individualized Study, New York University, New  
York, New York, USA < matt.stanley@nyu.edu >
- Joseph S. Tenn, Department of Physics and Astronomy, Sonoma State University,  
Santa Rosa, California, USA < joe.tenn@sonoma.edu >
- Laird Thompson, Astronomy Department, University of Illinois, Champaign-Urbana,  
Illinois, USA < lthomps@illinois.edu >
- Samantha Thompson, Lowell Observatory, Flagstaff, Arizona, USA  
< sthompson@lowell.edu >
- William Tift, Steward Observatory, University of Arizona, Tucson, Arizona, USA  
< wtift@Comcast.net >
- Helena Uthas, Department of Astronomy, Columbia University, New York, New York,  
USA < helena@astro.columbia.edu >
- Michael J. Way, NASA Goddard Institute for Space Studies, New York, New York,  
USA < michael.j.way@nasa.gov >
- Donna Weistrop, . . . , Flagstaff, Arizona, USA < weistrop@physics.univ.edu >