111th Meeting

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The 111th Annual Meeting of the
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Co-organized with
The Royal Astronomical Society of Canada and the
American Association of Variable Star Observers

July 1–7, 1999

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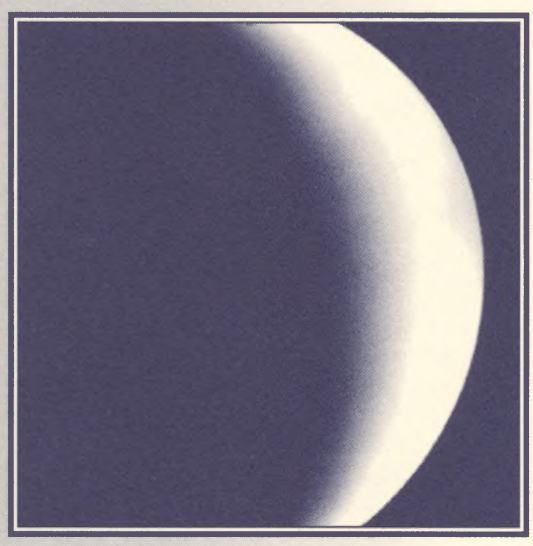

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Universe '99 is presented in cooperation with
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About the Astronomical Society of the Pacific

Since its inception in 1889, the Astronomical Society of the Pacific—a non-profit organization—has grown into the largest general astronomy society in the world, with members in all fifty states and over sixty-five other countries. The Society is unique in bringing together educators, professional and amateur astronomers, and many thousands of others intrigued by the universe and eager to share the wonders of astronomy. Our goal is to enhance public understanding of astronomy through a variety of programs and resources. Thank you for being a part of our 111th Annual Meeting. Visit the ASP membership booth, become a new member at the meeting, and receive an ASP lapel pin.

ASP
390 Ashton Avenue
San Francisco, CA 94112
Tel: 415.337.1100 Fax: 415.337.5205
www.aspsky.org

ABOUT THE RASC

The Royal Astronomical Society of Canada traces its roots to 1868, and was incorporated in 1890. It now has 23 branches across Canada, and 3000 members in Canada and abroad. Its goal is to advance astronomy and allied sciences. Its members come from all walks of life. It publishes a Journal which contains a wide variety of articles on Canadian astronomy, and an annual Observer's Handbook which is the most respected and widely-used book of its kind. The branches and members of the RASC are involved in many public education projects and programs, and in the preservation of Canadian astronomical history and heritage. They have played a major role in the establishment of observatories and planetariums in Canada. Several members have received international recognition for their contributions to astronomical research and education. Visit the RASC National Headquarters at: 136 Dupont St., Toronto, Ontario M5R 1V2; phone (416) 924-7973; e-mail: rasc@rasc.ca; website: www.rasc.ca

ABOUT THE AAVSO

The American Association of Variable Star Observers, founded in 1911, is the largest organization of variable star observers worldwide, with members in 45 countries. Measurements of variable stars provide astronomers with essential information about the nature and evolution of the stars. The purpose of the AAVSO is to coordinate variable star observations made largely by dedicated amateur astronomers, evaluate the accuracy of these observations, compile, process, and publish them, and make them available to researchers and educators. The AAVSO now receives over 350,000 measurements a year, from 550 observers worldwide. These measurements are archived in an electronic database, containing over 8.5 million measurements. The demand for these measurements, by researchers and educators, has increased by a factor of 25 in the last two decades partly as a result of major collaborations in space astronomy. Visit the AAVSO at: 25 Birch St., Cambridge MA 02138-1215; phone: (617) 354-0484; e-mail: aavso@aavso.org; website: www.aavso.org

ABOUT THE UNIVERSITY OF TORONTO

University of Toronto is the first-ranked Research University in Canada. It is world-famous for its research and discoveries in astronomy, including the first proof of a black hole in space, the discovery of the brightest supernova in four centuries, and the understanding of how galaxies have formed since the birth of the universe. It is also host to the Canadian Institute for Theoretical Astrophysics, a national institute with an international reputation. The University is also deeply engaged in astronomy education at the undergraduate and graduate level, and in many aspects of public education. Its David Dunlap Observatory houses the largest optical telescope in Canada. Visit the Astronomy Department at: 60 St. George St., Toronto, Ontario M5S 3H8; phone: (416) 978-2016; website: www.astro.utoronto.ca

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Brian Beattie, Don Fernie, Bob Garrison, Florence Unwin

SPECIAL THANKS
Professor E.R. Seaquist (Chair: Department of Astronomy)
Councillor Blake Kinahan
Denis McGowan
Marilyn Steinberg
Jack Flynn at his 21th ASP meeting
And our wonderful volunteers!

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Schedule of Events

THURSDAY, JULY1	EVENT	LOCATION
9:00 a.m. - 8:00 p.m.	Registration	Medical Science Stone Lobby
9:00 a.m. - 5:00 p.m.	RASC National Council Meeting	Croft Chapter House
7:30 p.m. - 10:00 p.m.	Campus Observatory Open House and Reception	Campus Observatory and Physics Lounge
9:00 p.m. - 10:00 p.m.	Murphy Slide Show	MP 102

FRIDAY, JULY 2	EVENT	LOCATION
8:00 a.m. - 8:00 p.m.	Registration	Medical Science Stone Lobby
8:30 a.m. - 5:30 p.m.	ASP Universe '99 Exhibits Preview	Medical Science Stone Lobby
9:00 a.m. - 5:00 p.m.	RASC Contributed Papers Session	Medical Science 3153
9:00 a.m. - 5:00 p.m.	RASC Displays	Medical Science Alumni Lounge
9:00 a.m. - 5:00 p.m.	Teacher's Workshop	Medical Science 3154, 3171, 3163
2:00 p.m. - 5:00 p.m.	Hands-on Astrophysics Workshop	Medical Science 2173
6:00 p.m. - 10:00 p.m.	An Evening at the Ontario Science Centre and OMNIMAX Theatre	Ontario Science Centre

SATURDAY. JULY 3	EVENT	LOCATION
8:00 a.m. - 6:00 p.m.	Registration	Medical Science Stone Lobby
8:30 a.m. - 6:00 p.m.	ASP Universe '99 Exhibits	Medical Science Stone Lobby
9:00 a.m. - 4:00 p.m.	Teachers' Workshop	Medical Science 3153, 3163, 4171, 2172, 3171
9:00 a.m. - 4:00 p.m.	ASP Universe '99 Lectures	McLeod Auditorium and Medical Science 3154
9:00 a.m. - 4:00 p.m.	Family Fair	Medical Science Cafeteria
9:00 a.m. - 6:00 p.m.	RASC Displays	Medical Science Alumni Lounge
9:00 a.m. - 1:00 p.m.	RASC Annual Meeting	Medical Science 3171
9:00 a.m. -12 noon	AAVSO Business Meeting	Medical Science 2173
1:00 p.m. - 4:00 p.m.	AAVSO Contributed Papers	Medical Science 2173
4:15 p.m. - 6:00 p.m.	Ruth Northcott Keynote Lecture: featuring Dr. Geoff Marcy	Convocation Hall
6:30 p.m. - 7:30 p.m.	No-Host Bar Reception	Wetmore Hall, New College
7:30 p.m. - 10:00 p.m.	ASP/RASC/AAVSO Gala Awards Banquet	Wetmore Hall, New College

Schedule of Events

SUNDAY, JULY 4	EVENT	LOCATION
8:00 a.m. - 6:00 p.m.	Registration	Medical Science Stone Lobby
8:30 a.m. - 6:00 p.m.	ASP Universe '99 Exhibits	Medical Science Stone Lobby
9:00 a.m. - 4:00 p.m.	ASP Universe '99 Lectures	McLeod Auditorium and Medical Science 3154
9:00 a.m. - 4:00 p.m.	Family Fair	Medical Science Cafeteria
9:00 a.m. - 4:00 p.m.	ASP History Lectures	Medical Science 3153
9:00 a.m. - 5:00 p.m.	ASP History Posters	Medical Science Alumni Lounge
1:00 p.m. - 5:00 p.m.	Astronomers in the Schools Workshop	Medical Science 3163
5:30 p.m. - 6:30 p.m.	ASP Membership Meeting	Medical Science 2173
7:00 p.m. - 10:00 p.m.	Scientific Symposium Reception	Brennan Hall Lounge, 81 St. Mary's Street

MONDAY, JULY 5	EVENT	LOCATION
8:00 a.m. - 5:00 p.m.	Registration	Medical Science Stone Lobby
8:30 a.m. - 1:00 p.m.	ASP Universe '99 Exhibits	Medical Science Stone Lobby
9:00 a.m. - 4:00 p.m.	Symposium on Amateur-Professional Partnership in Astronomy Research and Education	Medical Science 3153
9:00 a.m. - 4:00 p.m.	Symposium Posters	Medical Science Alumni Lounge
5:00 p.m. - 10:00 p.m.	Tour and Reception David Dunlap Observatory	David Dunlap Observatory

TUESDAY, JULY 6	EVENT	LOCATION
8:00 a.m. - 3:00 p.m.	Registration	Medical Science Stone Lobby
9:00 a.m. - 5:00 p.m.	Symposium on Amateur-Professional Partnership in Astronomy Research and Education	Medical Science 3153
9:00 a.m. - 5:00 p.m.	Symposium Posters	Medical Science Alumni Lounge

WEDNESDAY, JULY 7	EVENT	LOCATION
8:00 a.m. - 12 noon	Registration	Medical Science Stone Lobby
9:00 a.m. - 5:00 p.m.	Symposium on Amateur-Professional Partnership in Astronomy Research and Education	Medical Science 3153
9:00 a.m. - 5:00 p.m.	Symposium Posters	Medical Science Alumni Lounge

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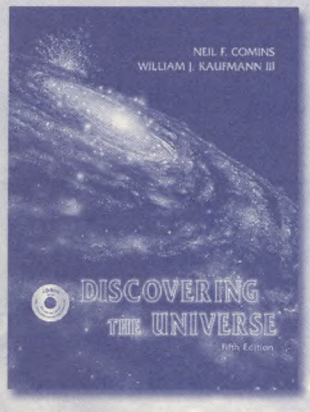

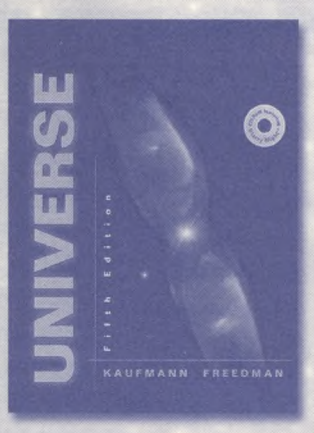

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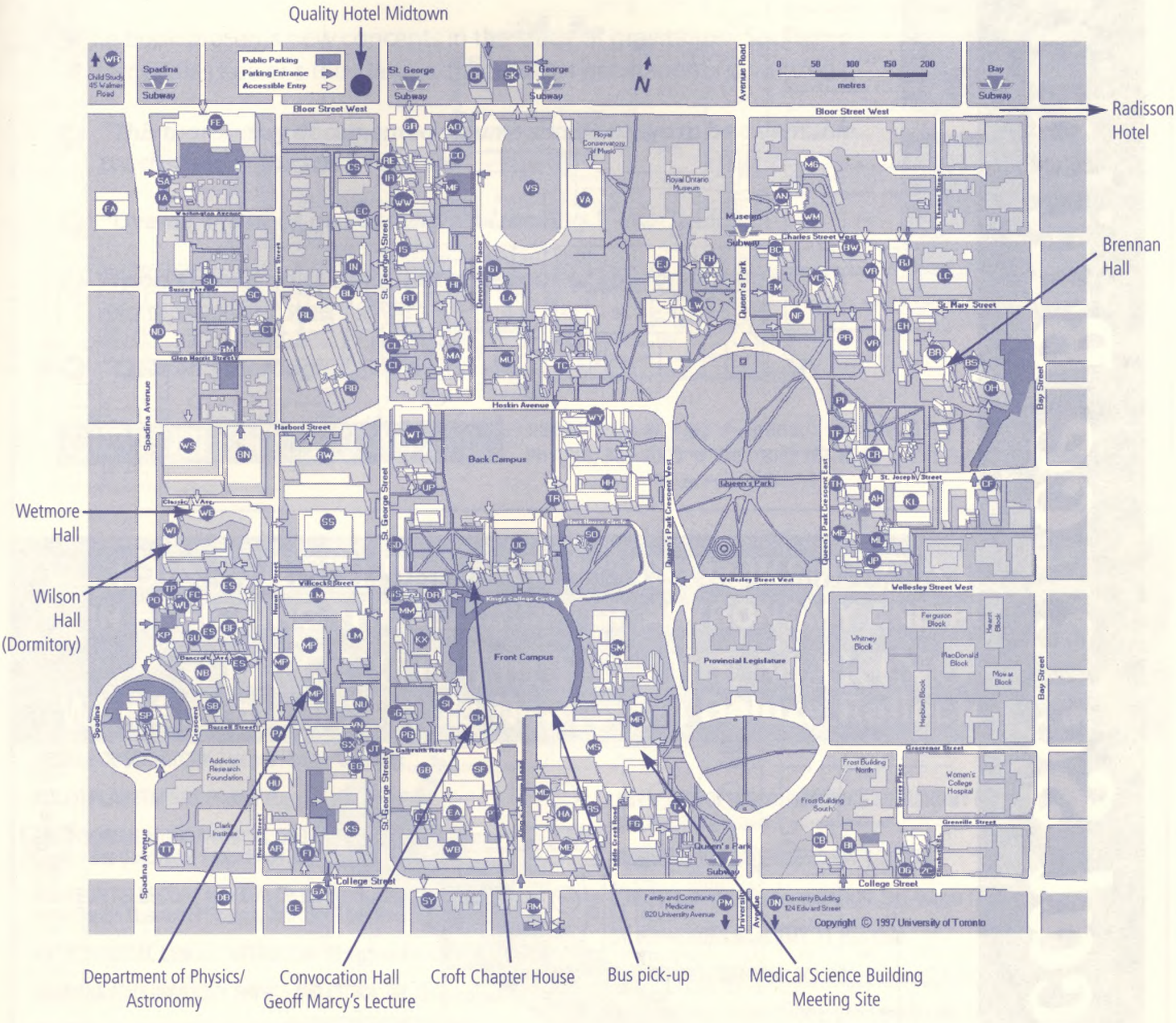


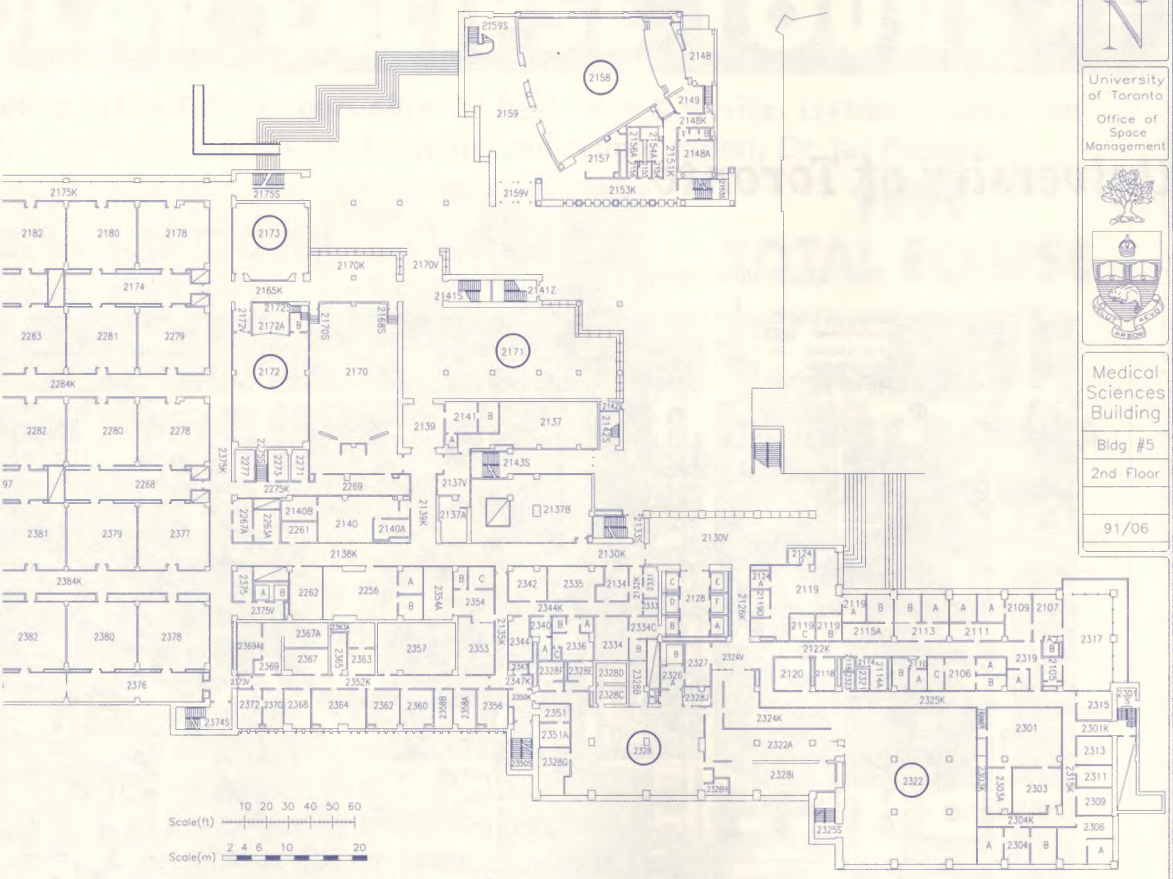
LOCATIONS

Meeting Site: Medical Sciences Building - 1 King's College Circle
Geoff Marcy's Lecture: Convocation Hall - 31 King's College Circle
Banquet: Wetmore Hall - 300 Huron Street
Dormitory: Wilson Hall, New College - 40 Willcocks Street
Quality Hotel Midtown: 280 Bloor Street West
Radisson Hotel: 90 Bloor Street East
Croft Chapter House: 15 King's College Circle
Symposium Reception: Brennan Hall - 81 St. Mary's Street
Observatory Open House and Reception: Physics Lounge - 60 St. George Street

Medical Science Building #5

SECOND FLOOR

Queen's Park Crescent West



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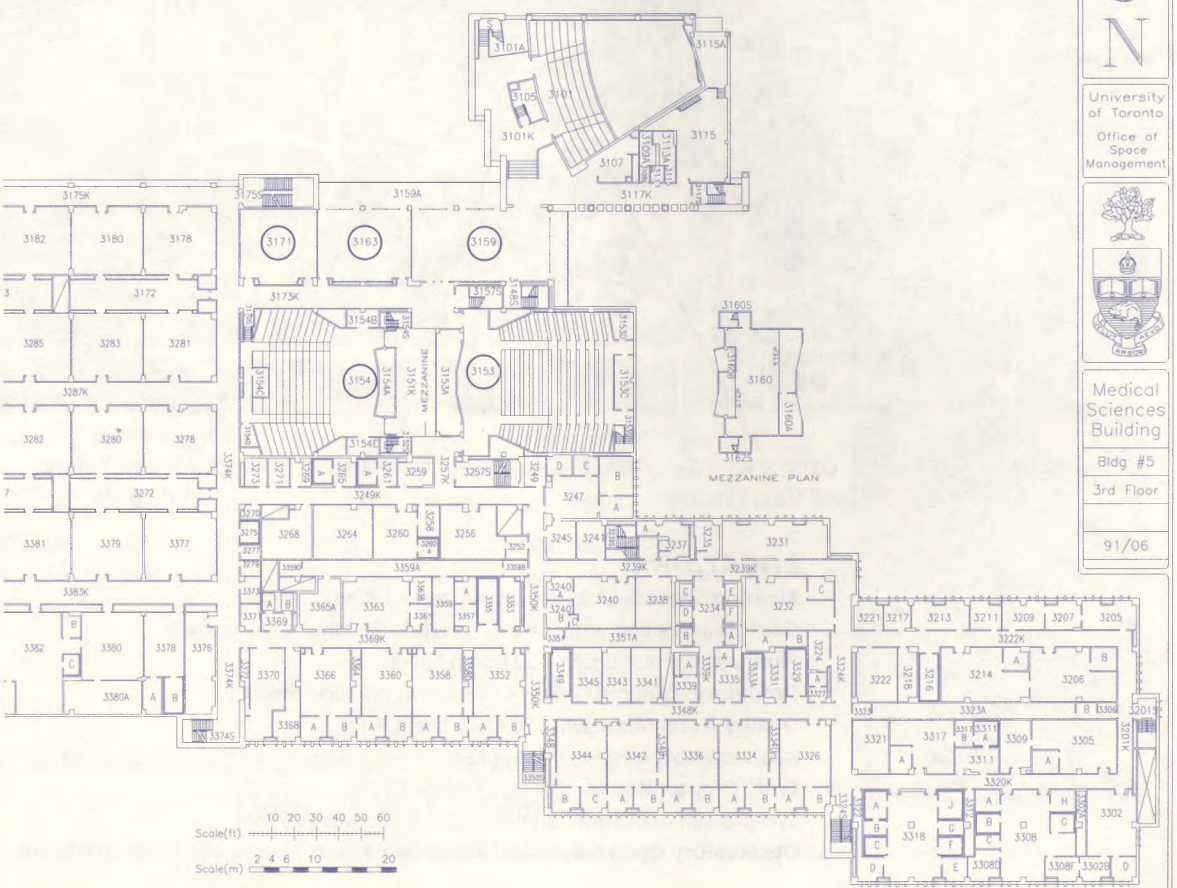

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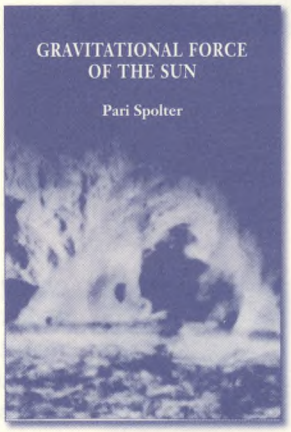
Gravitational Force of the Sun

by Pari Spolter, Ph.D.



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Universe '99 Events, Workshops and Symposia

CAMPUS OBSERVATORY OPEN HOUSE AND RECEPTION
Thursday, July 1
7:30 p.m. – 10:00 p.m.
Physics/Astronomy Building, 60 St. George Street
View the stars (weather permitting), the 8" and 16" telescopes, exhibits and displays, the city skyline, and the holiday fireworks from the highest point on campus—the Physics/Astronomy building. Meet new friends and old over refreshments and a cash bar. Experience the "Murphy Slide Show" and other zany RASC traditions. Your hosts: the University of Toronto Department of Astronomy and its graduate students.

TEACHERS' WORKSHOP
The Universe in the Classroom: a workshop on teaching astronomy in grades 3–12.
Friday – Sunday, July 2 – 4
9:00 a.m. – 5:00 p.m.
Medical Science Building
Includes Universe '99.

ONTARIO SCIENCE CENTRE
Friday, July 2
6:00 p.m. – 10:00 p.m.
Ontario Science Centre
Visit one of the world's foremost hands-on Science Centres, and enjoy the Oscar-nominated OMNIMAX film, *Cosmic Voyage*, in the 360 degree dome. Light refreshments and transportation are provided.

AWARDS BANQUET
Saturday, July 3
6:30 p.m. – 10:00 p.m.
Wetmore Hall
There will be a no-host bar from 6:30 to 7:30 p.m., followed by the ASP, RASC, and AAVSO's Annual Awards Banquet. During this banquet, we will be announcing the various anticipated Annual Awards to astronomers and educators.

ASP MEMBERSHIP MEETING
Sunday, July 4
5:30 p.m. – 6:30 p.m.
Medical Science, Room: 2173

SCIENTIFIC SYMPOSIUM RECEPTION
Sunday, July 4
6:30 p.m. – 9:00 p.m.
Odette Lounge, Brennan Hall,
St. Michael's College, 81 St. Mary's Street

SCIENTIFIC SYMPOSIUM:
Monday – Wednesday, July 5 – July 7
9:00 a.m. – 5:00 p.m.
Medical Science Building, Room: 3153
Includes Universe '99 and a conference proceedings.

DAVID DUNLAP OBSERVATORY TOUR
Monday, July 5
5:00 p.m. – 10:00 p.m.
David Dunlap Observatory
Buses will begin departing at 5:00 p.m. and shuttle you to the David Dunlap Observatory located 45 minutes away and home of the largest telescope in Canada. You can enjoy an informal meal and an informal talk on the history and scientific work of the observatory along with a tour of the facility. Buses will return, starting at 9:00 p.m.

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SILENT AUCTION
Saturday & Sunday, July 3 & 4
8:30 a.m. Saturday-3:30 p.m. Sunday
Stone Lobby in the Medical Sciences Building

How does a Silent Auction Work?
The ASP starts the bid at the top of the page and lists what the minimum bid increments must be thereafter. The top bid wins (or, if there are more than one of the items, the corresponding number of top bidders win). Checks, cash, MasterCard, Visa, and Discover cards are accepted for payment.

When does the bidding end?

Sunday, July 4, at 3:30 p.m. the bidding is closed and the sheets come down. The top bidders will be posted and must make arrangements to pay and pick up by 6:00p.m. (or make arrangements for mailing of larger items).

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The Sky—Windows, Software Bisque, www.bisque.com

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CCDSoft Astronomy Software—Windows, Software Bisque, www.bisque.com

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The NASA Atlas of the Solar System, Cambridge University Press, www.cup.org

$159.95 suggested retail price. In this volume, noted planetary cartographers Greeley and Batson describe and map every planet, moon, and small body that has been the subject of a NASA mission. 369 pp./214 color plates/157 maps. "These are images to die for, beautifully produced and guaranteed to amaze..."—New Scientist

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Splendors of the Universe slide set, ASP, www.aspsky.org

$99.00 suggested retail price. Five sets of 15 spectacular images of galaxies, nebula, star clusters, and other deep-sky objects from famed astrophotographer David Malin. Includes detailed caption booklet. For middle school and up.

Starry Night Deluxe, Sienna Software, www.siennasoft.com

$89.95 (CDN$127) suggested retail price. Like a planetarium on your desktop but with you in control! Discover stars, constellations, and deep sky objects. Explore the planets, ride a comet, or check out the view from MIR.

Sky Map Pro 5 (CD ROM), World Wide Software Pub.

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Stars & Stories (CD ROM), Wildridge Software, Inc.

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137-25 Pyramid w/World "7 w/ #25, Shasta Visions

$84.00 suggested retail price.

Nik Halogen Lamp, Zelco Industries, Inc.

$80.00 suggested retail price.

The Photographic Atlas of the Stars, Institute of Physics Publishing, www.iop.org

$63.00 suggested retail price. Authors: HJP Arnold, P Doherty and P Moore

Three-Video Set from NOVA, WGBH Boston

$60.00 suggested retail price. Eclipse of the Century, Countdown to the Invisible Universe, Death of a Star. Witness the sky's most exciting event-a total solar eclipse-viewed on July 11,1991 from high atop Mauna Kea in Hawaii. Explore the universe through the Infrared Astronomical Satellite (IRAS) which views regions of the sky once hidden from sight. Examine the power of supernova, the most violent of all celestial events, and its role in star formation. When it comes to the world around us, no one helps you understand it better than NOVA. Appropriate for high school and up.

Victorian Telescope Makers, Institute of Physics Publishing, www.iop.org

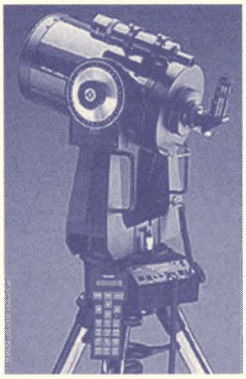
$60.00 suggested retail price. Author: IS Glass

Explore the Planets CD-ROM, TASA Graphic Arts, Inc, www.swcp.com/~tasa

$59.00 suggested retail price. This interactive, educational CD-ROM takes you on an illustrated tour of our solar system. In addition to viewing the fascinating landscapes of Earth and other worlds, you'll study the processes that sculpt them: volcanism, impact cratering, faulting and folding, landslides, water, and wind processes. Includes interactive exercises and the Explorer game.

Full Moon, Random House, www.randomhouse.com

$50.00 suggested retail price. The most thrilling of all journeys—the missions of the Apollo astronauts to the surface of the Moon and back—yielded 32,000 extraordinarily beautiful photographs, the record of a unique human achievement. Michael Light has woven 129 of these stunningly clear images into a single composite voyage, a narrative of breathtaking immediacy and authenticity that begins with the launch and is followed by a walk in space, an



8" LX200 Schmidt-Cassegrain Telescope, Meade Instruments, www.meade.com

Universe '99 Events, Workshops and Symposia

orbit of the Moon, a lunar landing and exploration, and a return to Earth with an orbit and splashdown.

Physically Speaking: A Book of Quotations on Physics and Astronomy, Institute of Physics Publishing, www.iop.org
$39.00 suggested retail price. Authors: CC Gaither and AE Cavazos-Gaither

Black Holes video, Ark Media
$20.00 suggested retail price

A Short History of the Universe, W.H. Freeman and Company
$19.95 paperback

Gravity's Fatal Attraction: Black Holes in the Universe, W.H. Freeman and Company
$19.95 paperback

Powers of Ten: A Book About the Relative Size of Things in the Universe, W. H. Freeman and Company
$19.95 paperback

Stars, W.H. Freeman and Company
$19.95 paperback

Astronomy Cafe: 365 Questions & Answers from "Ask the Astronomer," W.H. Freeman and Company
$14.95 suggested retail price, paperback

A Briefer History of Time: From the Big Bang to the Big Mac—A Parody, W.H. Freeman and Company
$14.95 paperback. Eric Schulman

Sharing the Universe, Berkeley Hills Books, http://berkeleyhills.com
$14.95 suggested retail price. Author Seth Shostak.

BOOK SIGNINGS

These will take place at the site of the lectures. The books are for sale outside the author's lecture room and the signings will take place immediately after the author's general lecture.

Saturday, July 3

9:00 a.m.	Fred Adams	The Five Ages of the Universe: Inside the Physics of Eternity
10:30 a.m.	Edward Kolb	Blind Watchers of the Sky
1:00 p.m.	Jack Newton & T. Dickinson	Splendor of the Universe

Sunday, July 4

9:00 a.m.	Terence Dickinson	Splendor of the Universe NightWatch 3rd Edition
1:00 p.m.	David Levy	More Things in Heaven & Earth

FAMILY FAIR

Organized and presented by the Ontario Science Centre and the Royal Ontario Museum
Saturday & Sunday, July 3 & 4
9:00 a.m.-4:00 p.m.
Medical Science Building - Cafeteria, Room 2322

The Ontario Science Centre and the Royal Ontario Museum join the celestial activities as part of Universe '99, a festival of presentations and exhibits for the general public. Children will love the interactive samples of Science Centre exhibits, while adults catch the latest developments in neutrino astronomy.

The Science Centre caters to children's intense interest in outer space with fascinating yet simple hands-on activities. Kids can land a lunar module on the moon, become human gyroscopes, or explore a professional star plate using some of the Centre's most popular astronomy-related exhibits. The display will also feature selected favourites from the Ontario Science Centre Sideshow Traveling Exhibition, where children can generate light by riding a bicycle or see the Bernoulli Effect in action as they float a ball in mid air. There are puzzles and illusions to baffle and amuse children of all ages.

The Royal Ontario Museum's portable planetarium provides the other half of the Fair. The ROM, located on the University of Toronto Campus, is one of the world's foremost museums. It has just opened a new exhibit on Earth Science. Its science educators are well known for their astronomy programs for school children of all ages.

The presentations in the planetarium will last about 20 minutes each and will show the night sky as seen from both light polluted city locations and spectacular dark country skies. The stars, constellations and planets of the early summer sky will be highlighted in a live, interactive presentation with a Royal Ontario Museum astronomy teacher. Children under 5 years of age not admitted. Limited, free, timed tickets available 15 minutes prior to each presentation. Complete shows every 45 minutes starting at 9:00 a.m. Last complete show at 3:00 p.m.

Guide to Exhibitors

EXHIBITORS LIST

American Association of Variable Star Observers (AAVSO)
Addison Wesley Longman
Astronomical Society of the Pacific (ASP)
Astronomy Magazine
Brooks/Cole Publishing (ITP Publishing)
Cambridge University Press
Canadian Space Society
International Dark-Sky Association
Mars Society
Meade M.Q.P.
Nelson Thomson Learning
Pacific Telescope Corp.
Pharaoh Enterprises
Psignologic Services
Sienna Software, Inc.
Sky Publishing Corp.
SOFIA
Students for the Exploration and Development of Space (SEDS)
The Royal Astronomical Society of Canada (RASC)
Walker & Company
Worth Publishers, Inc.

AMERICAN ASSOCIATION OF VARIABLE STAR OBSERVERS (AAVSO)

Cambridge, MA, USA

The AAVSO is an international organization specializing in collecting, analyzing, and disseminating variable star observations. Its unique curriculum, Hands-On Astrophysics, brings the night sky indoors and introduces students to variable star astronomy and research. www.aavso.org

ADDISON WESLEY LONGMAN

Menlo Park, CA, USA

Addison Wesley Longman is a college astronomy publisher of textbooks and multimedia products. New releases include a new introductory astronomy text, The Cosmic Perspective by Jeffrey Bennett, Megan Donahue, Nicholas Schneider, and Mark Voit and astrospot, (http://astrspot.com) the web-based companion journal to The Cosmic Perspective which covers the latest astronomy discoveries. Forthcoming is a general relativity textbook for the sophomore level, Scouting Black Holes: Exploring General Relativity with Calculus by Edwin F. Taylor and John Archibald Wheeler.
www.awl.com/physics

ASTRONOMICAL SOCIETY OF THE PACIFIC

San Francisco, CA, USA

Founded in 1889, the ASP is an international nonprofit scientific and educational organization that serves as a bridge between astronomers and the public. Selected items from our mail-order catalog of astronomical slides, videos, software, posters, books and observing aids will be available for sale. We will also be demonstrating RealSky CD, the Palomar Observatory Sky Survey on 9 CD-ROMs. www.aspsky.org

ASTRONOMY MAGAZINE

Waukesha, WI, USA

ASTRONOMY is the most popular English-language magazine in the universe for astronomy enthusiasts. Published monthly—it gives you the latest thoughts from the world's greatest minds on galaxies, planets, and stars. Visit us online at www.astronomy.com.

BROOKS/COLE PUBLISHING (ITP PUBLISHING)

Belmont, CA, USA

Brooks/Cole Publishing, a subsidiary of Thomson Learning, is a prominent physical science publisher of both textbooks and educational software. Disciplines include astronomy, physics, chemistry, mathematics, statistics, engineering and computer science.
www.brookscole.com

CAMBRIDGE UNIVERSITY PRESS

New York, NY, USA

Cambridge University Press has the largest astronomy list of any publisher in the world. We cater for general readers, amateur astronomers (from beginners through to advanced), undergraduates, graduate students and researchers. We invite you to discover Astrophotography for the Amateur, 2ed, New Solar System, Earth: Evolution of a Habitable World, Cosmological Physics, and many other exciting recent titles. Stop by our booth and receive a 20% discount on all our titles. www.cup.org

CANADIAN SPACE SOCIETY

Toronto, Ontario, CANADA

The objective of the Canadian Space Society is to sponsor and promote the involvement of Canadians in the development of space. We publish the Canadian Space Gazette and hold monthly meetings on various space-related topics. www.css.ca

INTERNATIONAL DARK-SKY ASSOCIATION

Tucson, AZ, USA

Promoting good outdoor lighting to conserve energy, to improve safety and security, and to preserve the beauty of our night skies. www.darksky.org

MARS SOCIETY

Toronto, ON, CANADA

The purpose of the Mars Society is to promote an international effort to explore and settle the planet Mars. This will be done through public outreach, and privately and government funded missions. www.wiznet.ca/~marinov/mars/index.html

MEADE M.Q.P.
Toronto, ON, Canada

Founded in 1972, Meade Instruments is the world's largest manufacturer of telescopes for the serious amateur astronomer. We specialize in computerized telescopes (LX200 series telescope, Meade new autostar system,...) www.meade.com

NELSON THOMSON LEARNING
Scarborough, Ontario, Canada

Nelson Thomson Learning's proven success in science publishing and the acquisition of DC Heath Canada Publishers and Wiley and Sons Publishers underlies a commitment to providing quality science resources for grades 7 to 12 students. The Nelson Science Development Team includes experienced authors, consultants, and expert reviewers with extensive educational and publishing experience. The commitment to science publishing excellence continues now with the development of Nelson Science 9 and 10 for the new Ontario Curriculum and the future development of senior science resources for chemistry, biology, physics and earth and space sciences. www.nelson.com

PACIFIC TELESCOPE CORP.
Richmond, British Columbia, CANADA

Pacific Telescope Corp. manufactures and wholesales a wide range of products including: 76-200mm Reflector telescopes, 60-150mm Refractor telescopes, Spotting Scopes, and Binoculars. Showroom in Richmond, B.C., Canada.

PHARAOH ENTERPRISES
Lake Zurich, IL, USA

Manufacturer of ankh symbol jewelry, gold or silver pendants and earrings, selling retail and wholesale via mailorder. Also offering selected books on earth history and ancient human history.

PSIGNOLOGIC SERVICES
Vancouver, BC, CANADA

TryOrbit 4.0 simulates orbits around Earth. TryOrbit 4.5 simulates orbits around Earth and Moon, also simulates transfers to Moon and orbit captures. Both products feature extensive online documentation, including diagrams and equations.

SIENNA SOFTWARE, INC.
Toronto, ON, CANADA

Sienna introduces the brand new Starry Night Pro™. Examine dynamic H-R diagrams, 3D stars viewable from up to 20,000 light years away, and many more features never before available. Buy your copy at Universe '99! www.siennasoft.com

SKY PUBLISHING CORP.
Cambridge, MA, USA

Sky Publishing is the publisher of Sky & Telescope, the Essential Magazine of Astronomy, as well as many fine astronomy books and products. www.skypub.com

SOFIA
NASA Ames Research Center, CA, USA

The Stratospheric Observatory for Infrared Astronomy, a converted 747SP carrying a 98-inch diameter telescope, is expected to begin science operations in 2002. We are already starting a mailing list of teachers, amateur astronomers, and other educators who will be recruited to accompany astronomers and make research flights aboard SOFIA. http://sofia.arc.nasa.gov/

STUDENTS FOR THE EXPLORATION AND DEVELOPMENT OF SPACE
Toronto, ON, Canada

Students for the Exploration and Development of Space (SEDS) was founded in 1980. SEDS-Canada, founded in 1992, organizes local and regional conferences, publishes a quarterly newsletter, holds an annual multimedia contest, and makes available a scholarship based on academic merit and involvement in SEDS activities.

THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

The Royal Astronomical Society of Canada, with roots tracing back to 1868, is Canada's largest astronomical society, encompassing 23 local Centres across the country. The RASC publishes the annual Observer's handbook which is the most widely used astronomical yearbook available today.

WALKER & COMPANY
New York, NY, USA

Walker & Company is a general-interest book publisher in New York City. We have published books such as Dava Sobel's Longitude. Our latest book, by science writer Kitty Ferguson, is Measuring the Universe: Our Historic Quest to Chart the Horizons of Space and Time.

W.H. FREEMAN, INC.
New York, NY, USA

W.H. Freeman & Company are well known for quality textbooks, educational media products, and compelling science books for general audiences. Come browse our best sellers Universe, 5/e by Kaufmann/Freedman, and Discovering the Universe 5/e (Due July 1999) by Comins/Kaufmann (both packaged with a student version of the award winning software Starry Night™ from Sienna software), and our other products for physics and astronomy. www.whfreeman.com

Universe '99 Speakers Schedule

Saturday, July 3

TIME	MS 2158	MS 3154	CONVOCATION HALL
9:00 a.m.	Tom Bania	Fred Adams	
10:30 a.m.	Edward Kolb	Stephen Schneider	
12:00 p.m.	lunch	lunch	
1:00 p.m.	Robert Naeye	Jack Newton	
2:30 p.m.	Alexei Filippenko	Aileen O'Donoghue	
4:00 p.m.			Ruth Northcott Lecture: Geoff Marcy

Sunday, July 4

TIME	MS 2158	MS 3154
9:00 a.m.	Terence Dickinson	Daniel Weedman
10:30 a.m.	Andrew Fraknoi	Martin Duncan
12:00 p.m.	lunch	lunch
1:00 p.m.	David Levy	Harry Shipman
2:30 p.m.	Sallie Baliunas	Joseph Patterson
4:00 p.m.	Marcia Bartusiak	Ivan Semeniuk

History Speakers Schedule

Sunday, July 4, Medical Science Building, Room MS 3153

TIME	SPEAKER	TALK TITLE
9:00 a.m.	Thomas R. Williams	Getting organized: U.S. amateur astronomy from 1860 to 1985
9:40 a.m.	Peter Broughton	Confidence and deference the origins and development of the RASC
10:20 a.m.	Break	
10:40 a.m.	Richard A. Jarrell	Peter Millman's army: Amateurs and professionals in Canadian meteor programmes
11:20 a.m.	Kenneth I. Kellermann	Grote Reber: Pioneer of radio astronomy
12:00 noon	Break	
1:30 p.m.	Julian A. Smith	The beginnings of navigational astronomy in Canada
2:10 p.m.	Dorritt Hoffleit	Canadian astronomers with early Harvard PH.D.'s
2:50 p.m.	Break	
3:10 p.m.	John W. Briggs	The great instruments of the Grubb telescope-making dynasty
3:50 p.m.	Barbara Becker	"A spring of water in a dry and thirsty land": William Huggins and the origins of astrophysics

Speaker Biographies and Abstracts

GENERAL SESSIONS

FRED C. ADAMS
University of Michigan
"Into the Dark: The Long Term Fate of Astrophysical Objects in a Dying Universe"
Saturday July 3, 9:00am
Medical Science 3154
This talk outlines astrophysical issues related to the long term fate of the cosmos. We consider the evolution of planets, stars, stellar populations, galaxies, and the universe itself over time scales which greatly exceed the current age of the universe. As the universe grows ever older, stars give way to degenerate stellar remnants—the neutron stars, white dwarfs, and brown dwarfs remaining at the end of stellar evolution. As the galaxy disperses, weakly interacting dark matter particles are accreted by white dwarfs, where they annihilate with each other and keep the stellar remnants relatively "warm". After accounting for the destruction of the galaxy, we consider the fate of the expelled degenerate remnants within the assumption that proton decay is a viable process; this evolutionary scenario is developed in some detail. After white dwarfs and neutron stars have disappeared, the remaining black holes slowly lose their mass as they emit Hawking radiation. After the largest black holes evaporate, the universe slowly slides into darkness.

Fred Adams is Associate Professor of Physics, and the Associate Chair of the Physics Department, at the University of Michigan. For his contributions to theoretical astrophysics, he received the Robert J. Trumpler Award from the Astronomical Society of the Pacific, the Helen B. Warner Prize from the American Astronomical Society, and the National Science Foundation Young Investigator Award. He has also been awarded both the Excellence in Education Award and the Excellence in Research Award from the College of Literature, Arts, and Sciences at the University of Michigan. He is the co-author (with G. Laughlin) of a new book on the future of the universe: THE FIVE AGES OF THE UNIVERSE: Inside the Physics of Eternity (The Free Press, June 1999).

SALLIE BALIUNAS
Center for Astrophysics
"The Sun, Our Star"
Sunday July 4, 2:30 p.m.
Medical Science 2158
The changing surface magnetism of the sun produces variations in its emitted light and particles. Changes in the sun's energy output can influence life on and the environment of earth. This talk will discuss new satellite observations of the sun and earth, combined with studies of sunlike stars, which are yielding new insight on the past, present and future effects of the sun on earth.

Sallie Baliunas is staff scientist at the Harvard-Smithsonian Center for Astrophysics, Deputy Director of Mount Wilson Observatory and Adjunct Professor at Tennessee State University.

THOMAS M. BANIA
Boston University
"Astronomy at 175 Kelvin: A Day in the Life of a South Pole Astronomer"
Saturday July 3, 9:00am
Medical Science 2158
Three principal instruments are now operating continuously at the geographic South Pole. The Antarctic Submillimeter Telescope and Remote Observatory, AST/RO, is probing the properties of the atoms and molecules in the gas between the stars, the interstellar medium. Images from an infrared telescope, ABU, are revealing the nature of the process of star formation. The VIPER telescope is mapping the sky at millimeter wavelengths searching for the signature of the first evolution of matter after the creation of the Universe by the Big Bang. This talk shares the excitement of recent discoveries and the romance of observing with these unique instruments.

From his base on the faculty at Boston University, Tom Bania studies the gas and dust between the stars using AST/RO at the South Pole. As an educator he developed "Cosmic Evolution", an interdisciplinary undergraduate course which follows the evolution of matter in the Universe, the evolution of life on Earth, the ascent of Humankind and the invention of civilization and technology.

MARCIA BARTUSIAK
Author and Science Writer
"Charting the Cosmos to the Edge of Time"
Sunday July 4, 4:00 p.m.
Medical Science 2158
For decades, astronomers struggled to peer into the depths of space to catch a young galaxy in the making. But "there," wrote Edwin Hubble, "we measure shadows...and search for landmarks that are scarcely substantial." No longer. This talk will describe the march outward and the key technological breakthroughs in the 1990s that have at last allowed astronomers to image galaxies farther back in time than ever before. They are revealing a young cosmos near the edge of the visible universe, an event described as one of the major moments in 20th-century astronomy.

Marcia Bartusiak is the author of "Through a Universe Darkly" and "Thursday's Universe." An award-winning

science writer, she has been covering the fields of astronomy and physics for such publications as Discover, where she is a contributing editor, and Astronomy, as a member of its editorial advisory board. Her latest book, "Einstein's Unfinished Symphony" about gravity-wave astronomy, will be published next year.

TERENCE DICKINSON
SkyNews magazine
"Basics of Backyard Astronomy"
Sunday July 4, 9:00 a.m.
Medical Science 2158
For many people, getting started is the hardest part of taking up astronomy as a hobby. Likewise, initial attempts at astrophotography can be equally frustrating for the novice. Often overwhelmed by jargon and romanced by telescope advertising, the beginner can feel adrift in unknown waters. This talk concentrates on the essentials that every beginner needs to know—information that provides a basis for effective equipment and accessory selection.

Terence Dickinson is editor of SkyNews magazine and author of 14 astronomy books, including the best-selling beginner's guide NightWatch. He has been a full-time astronomy writer and communicator for more than 30 years.

MARTIN DUNCAN
Queen's University, Kingston
"The Kuiper Belt: Tantalizing Clues About Planet Formation"
Sunday July 4, 10:30am
Medical Science 3154
In the middle of this century, Kenneth Edgeworth and Gerard Kuiper independently suggested that our planetary system is surrounded by a disk of material left over from the formation of the planets. Theoretical work in the 1980's suggested that this disk (now called the Kuiper belt) was likely to be the reservoir supplying most of the comets now found orbiting closer to the Sun. Beginning with the discovery of its first member in 1992, the Kuiper belt has been transformed from a theoretical construct to a bona fide and well-populated component of the solar system. By now, over 100 Kuiper Belt objects (KBOs) have been discovered—a sufficiently large number that we can estimate the mass and spatial distribution in parts of the trans-Neptunian region. This talk will provide a comparison of the observed orbital properties of these objects with those found in theoretical studies and computer simulations. Some tantalizing clues to the formation and evolution of the outer Solar System are revealed.

Martin Duncan received his BSc (Honours Physics) from McGill University, MSc (Astronomy) from the University of Toronto, and PhD (Astronomy) from the University of Texas at Austin. He was a postdoctoral fellow at Cornell University and a faculty member at the Universities of Toronto and California at Santa Cruz before joining Queen's in 1988. He has subsequently been a visiting researcher at the Institute for Theoretical Physics in Santa Barbara and at the Southwest Research Institute in Texas and Colorado. He is currently Head of the Physics Department at Queen's and Second Vice President of the Canadian Astronomical Society.

ALEX FILIPPENKO
University of California at Berkeley
"Einstein's Biggest Blunder? The Case for Cosmic 'Antigravity'"
Saturday July 3, 2:30 p.m.
Medical Science 2158
Recently, observations of very distant supernovae (exploding stars) have provided evidence that the expansion of the Universe is accelerating with time, rather than decelerating as expected. This resurrects the idea of a long-range "antigravity" effect in the Universe, first proposed by Albert Einstein and later renounced as his biggest blunder. If correct, it implies that the Universe will expand forever, and that space is geometrically flat on large scales. Moreover, the derived age of the Universe is 14 billion years, consistent with the ages of the oldest known stars. This work was voted the "Science Breakthrough of 1998" by Science magazine.

Alex Filippenko received his Ph.D. in Astronomy in 1984 from Caltech. After two years of postdoctoral work at UC Berkeley, he joined the faculty and has remained there through the present time. An observational astronomer who makes frequent use of the Hubble Space Telescope and the Keck 10-meter telescopes, his primary areas of research are supernovae, active galaxies, black holes, and observational cosmology. He has won numerous awards for his teaching and research. In 1998 he produced a 40-lecture video course on introductory astronomy with The Teaching Company. He is currently Vice President of the ASP.

ANDREW FRAKNOI
Foothill College & A.S.P.
"Nancy Reagan's Astrologer, the Roswell Incident, and the 'Face' on Mars: Separating the Science from the Fiction"
Sunday July 4, 10:30am
Medical Science 2158
Thanks to the popular media, an enormous amount of attention has been given to some pretty amazing claims on the fringes of astronomy. These include the idea that

Speaker Biographies and Abstracts

your life path and romantic destiny are determined by the position of objects in the sky at the moment of your birth; that extraterrestrial space-craft have landed on our planet (and sometimes kidnapped innocent citizens); that an ancient race left us a clear message on the planet Mars in the shape of a human face; and that a giant alien ship had been following Comet Hale-Bopp in 1997, but astronomers and government officials were covering up the news.

In this illustrated talk, astronomer and popular lecturer Andrew Fraknoi will discuss the most famous pseudo-science claims related to astronomy, and provide the background and analysis needed to appreciate them properly. He will unveil some recent detective work about these cases, and show how there is often a lot LESS to them than initially meets the eye. And he will show how a few skeptical questions can help deflate the claims of the true believers. Attendees will receive a free resource guide for clear-headed examination of some of the most interesting cases of astronomical pseudo-science.

Andrew Fraknoi is the Chair of the Astronomy Department at Foothill College and the Director of Project ASTRO at the Astronomical Society of the Pacific. He served as the Society's Executive Director for 14 years, and was the founding editor of its newsletter for teachers. He has organized over 20 national workshops on teaching astronomy, and has given almost 400 public lectures, on topics ranging from the evidence for the big bang to the best tourist sights in the solar system. Among the thirteen books he has written or edited, he is the lead author of Voyages Through the Universe (1997, Saunders) - the first college astronomy text with jokes - which is now one of the leading astronomy textbooks in the U.S. and Canada. He appears regularly on local and national radio explaining scientific developments in everyday language, and is an astronomy correspondent for two programs on National Public Radio. In 1992, the International Astronomical Union named asteroid 4859 Asteroid Fraknoi in recognition of his contributions to the public understanding of astronomy.

EDWARD "ROCKY" KOLB
Fermi National Accelerator Lab
"Much Ado About Nothing: Emergence of Matter, Radiation, and Spacetime from Nothing"
Saturday July 3, 10:30am
Medical Science 2158
Long before the appearance of planets, stars, or galaxies, the universe consisted of a primordial soup of "elementary" particles. In this formless, shapeless soup were the seeds of the beautiful and complex universe we observe today. The lecture will review what we know about the primordial soup, and discuss the possibility that the primordial soup, and even spacetime itself, arose from a state of vacuum, or literally, from "nothing."

Edward W. Kolb is an Astrophysicist at Fermi National Laboratory where he applies elementary particle physics to a study of the very early universe. He has authored over 200 scientific papers and co-authored a textbook on cosmology and particle physics. As a professor of Astronomy and Astrophysics at the University of Chicago he has been cited for excellence in undergraduate teaching. He enjoys interpreting cosmology in the popular press both as author and spokesperson. His popular-level book, Blind Watchers of the Sky, has won awards for excellence and he has written numerous articles in newspapers and magazines, appeared in several television productions, and given popular talks on cosmology throughout the world.

DAVID H. LEVY
Jarnac Observatory, Inc.
"Finding Comets in Changing Times"
Sunday July 4, 1:00 p.m.
Medical Science 2158
This is a talk about how, where, and why people search for Comets. Whether amateur, or professional, comet hunters are a unique group dedicated to patrolling the sky in search of these bodies.

David H. Levy is one of the most successful comet discoverers in history. He has discovered twenty-one comets, eight of them using his own backyard telescope. With Eugene and Carolyn Shoemaker at the Palomar Observatory in California he discovered Shoemaker-Levy 9, the comet that collided with Jupiter in 1994. Levy is the author of twenty-one books. He writes the monthly "Startrails" colum for Sky and Telescope magazine and the "Nightfall" feature for the Canadian magazine SkyNews. As the Science Editor for Parade magazine he regularly reaches 80 million readers with his messages in support of science education. Asteroid 3673 (Levy) was named in his honor.

ROBERT NAEYE
Astronomy magazine
"Brown Dwarfs: The Little Stars That Couldn't"
Saturday July 3, 1:00 p.m.
Medical Science 2158
Life was easy for astronomers before 1995: There were stars, and there were planets. But along came brown dwarfs to muddy the waters. Not quite stars and not quite planets, brown dwarfs inhabit the murky realm in-between. For decades astronomers searched in vain for these elusive objects. But ever since technology rose to the challenge in 1995, brown dwarfs have popped out of the woodwork. It's no longer a question of whether

brown dwarfs exist, astronomers now concern themselves with deeper questions: How common are they? How do they evolve? What is their weather like? And how much do they account for the universe's "missing mass"?

Robert Naeye is an associate editor for Astronomy magazine. He writes and edits many of the magazine's news and science feature articles. Before joining Astronomy in 1995, Naeye worked on the editorial staffs of Discover and Sky & Telescope magazines. He is author of the book "Through the Eyes of Hubble: The Birth, Life, and Violent Death of Stars" (Kalmbach Publishing Co., 1998).

JACK NEWTON
Florida Imaging Center
"CCD Imaging"
Saturday July 3, 1:00 p.m.
Medical Science 3154
Never before have amateurs been better poised to make significant contributions to astronomy than today. The CCD camera enables everyone with access to even the most modest telescope to image objects never before seen from Earth. This slide presentation covers the latest in color CCD imaging and illustrates how amateurs can play a valuable role in cutting-edge research.

A lifetime member of the Royal Astronomical Society of Canada, Jack Newton is also a past member of the Board of Directors of the Astronomical Society of the Pacific. In 1988, Jack was awarded the ASP's coveted Amateur Achievement Award. Now retired, Jack devotes his time to teaching astrophotography from his homes in Canada and Florida.

AILEEN A. O'DONOGHUE
St. Lawrence University
"The Songs of Ancient Electrons"
Saturday July 3, 2:30 p.m.
Medical Science 3154
Clusters of galaxies are some of the largest structures in the universe. Thus they were assumed to be very old and, in the case of rich clusters, quite relaxed, that is, in stable equilibrium states free of all traces of their formation. However, VLA images of giant central galaxies in rich clusters revealed jets and tails of plasma shining by the light of energetic electrons caught in magnetic fields.

The jets bend and the tails billow and twist as though blown by the wind. Analysis of these images, particularly the bending of the tails, could not be reconciled with the assumption of relaxed clusters. I will display a number of images, describe the analysis that challenged our ideas about clusters of galaxies, and show what subsequent spectroscopic and X-ray data have revealed about these vast entities.

Aileen O'Donoghue is Associate Professor of Physics at St. Lawrence University in Canton, New York. She has regularly used the VLA since 1984 and has been a visiting scientist at both Cornell University and at NRAO/VLA. At St. Lawrence University, most of her creative energies are successfully focused on communicating the excitement of physics and astronomy to non-science majors. In her spare time she is a contributing editor to Adirondack Magazine. In 1993 she was the recipient of the Judge Francis Bergan Career Development Award in Astrophysics, awarded by the Dudley Observatory, Schenectady, New York.

JOE PATTERSON
Columbia University
"Astrophysics in the Backyard"
Sunday July 4, 2:30 p.m.
Medical Science 3154
Amateur astronomers have a long tradition of contributing to astronomical knowledge. The silicon revolution has now brought powerful research instruments into thousands of backyards, creating research opportunities undreamed of a decade ago. The trick is how to use the toys. We've organized the Center for Backyard Astrophysics (CBA), a band of astronomical infantry spread around the planet and coordinating observation of rapid periodic signals in variable stars. I'll describe how we use the network for studies of accretion disks around compact stars, reaching sensitivities far better than single telescopes of any size.

Joe Patterson started his astronomy career at noon on March 7, 1970, on a beach in Virginia, and bought his first telescope the next day. Which was hard to do, because in those days it was illegal to buy telescopes on a Sunday. Within a week he was bringing high school students into New York City parks for observing, and trying to keep one step ahead of them. He started careers as a high school teacher, sportswriter, and summer camp director before entering the astronomy mainstream with a PhD from Texas in 1980. He is now a Professor of Astronomy at Columbia University, and specializes in the structure and evolution of cataclysmic variable stars.

STEPHEN SCHNEIDER
University of Massachusetts
"2MASS"
Saturday July 3, 10:30am
Medical Science 3154
The 2-Micron All Sky Survey is creating a detailed photometric map of the entire sky at infrared wavelengths for the astronomical community. Actually it is a 1.2, 1.7, and 2.2 micron survey, but 2MASS rhymes with UMass!

Speaker Biographies and Abstracts

The data are being made available over the web, and catalogs of hundreds of millions of stars and millions of galaxies are being generated. Infrared light permits us to detect cool objects like brown dwarfs and faint red stars. And since interstellar dust has little effect on infrared light, we can see stars out to the far edge of the Milky Way and galaxies previously hidden from view. I will describe the project and some of the intriguing objects we've already discovered in the first stages of the survey.

Stephen Schneider is Professor of Astronomy at the University of Massachusetts (UMass). He is a graduate of Harvard with a doctorate from Cornell. He received the Trumpler Award of the A.S.P. in 1987 and a Presidential Young Investigator award in 1991. His research interests also include radio astronomy and galaxy dynamics.

IVAN SEMENIUK
Ontario Science Centre
"Beyond Light—The Promise of Neutrino Astronomy"
Sunday July 4, 4:00 p.m.
Medical Science 3154
Behaving more like cosmic ghosts than particles, neutrinos carry information about some of the most interesting and inaccessible places in the universe. This year, in Sudbury, Ontario, a neutrino detector stands poised to probe the sun's hidden furnace and provide advanced warning of the next supernova in our galaxy. In the process, it may re-write the standard model of physics. Meanwhile, even larger detectors are being built to capture neutrinos from beyond the galaxy. Is astronomy evolving from a science of many wavelengths into one of many messengers?

Ivan Semeniuk is a science writer and broadcaster based in Toronto. He develops exhibits and programs at the Ontario Science Centre and reports regularly on astronomy for the Discovery Channel, Canada.

HARRY SHIPMAN
University of Delaware
"How Stars End Their Lives"
Sunday July 4, 1:00 p.m.
Medical Science 3154
Black holes, neutron stars, and white dwarf stars occupy a particularly interesting niche in astronomy. Stars end their lives locked in gravity's embrace, shrinking down to near nothingness and packing lots of matter into very tiny balls or, in the case of black holes, unknown pinpricks of matter hiding beneath the event horizon. This talk will describe these stars and how they interact with the rest of the universe when (for example) they form planetary nebulae or light up the radio ski as pulsars.

Harry Shipman is Professor of Physics and Astronomy at the University of Delaware. He studies with any telescope in space that he can get time on, ranging from the Hubble Space Telescope to comparatively small astronomical explorer spacecraft. A former Education Officer of the American Astronomical Society and the author of four popular books, he publishes for general audiences, for the technical readers of professional journals, and in the field of science education.

DANIEL W. WEEDMAN
Pennsylvania State University
"Seeking the Most Distant Galaxies"
Sunday July 4, 9:00am
Medical Science 3154
Astronomers can now see more than 10 billion years into the past. Observations are finding galaxies being born when the Universe was young. The nature of these galaxies and the mysteries of their formation will be described along with the telescopic techniques, on Earth and in space, designed to discover the origins of galaxies.

Daniel Weedman is Professor of Astronomy and Astrophysics at the Pennsylvania State University. Prior to resuming this position, he was Director of the Astrophysics Division, NASA Headquarters, where he was responsible for overseeing all NASA astronomy missions. His current research concentrates on understanding newborn galaxies, and he is a member of the team building the spectrometer for NASA's Space Infrared Telescope Facility, the final Great Observatory, scheduled for launch in 2001.

THE RUTH NORTHCOTT LECTURE

GEOFFREY MARCY
"The Revolution in Planetary Systems"
Saturday July 3, 4:00 p.m.
Convocation Hall
The Doppler shifts of nearby stars have revealed some that wobble around in space, due to the gravitational pull of revolving planets. Over 20 planets have been found, including one full-fledged system of three planets around one star, Upsilon Andromedae, which enables comparison to our Solar System. The 20 extrasolar planets have masses in the range 0.5—5 Jupiters. We cannot detect smaller planets such as Earth-size ones. Nonetheless, the Jupiter-mass planets give us clues about the possibility of life on planets and moons in our Milky Way Galaxy. Strangely, most Jupiters orbit in elliptical orbits, suggesting that near misses among planets sculpt the architecture of planetary systems.

Geoffrey Marcy is internationally recognized for his

work to prove that planets exist outside the solar system. He is currently Distinguished Professor in the Department of Physics and Astronomy at San Francisco State University. He received his BS from UCLA and Ph.D. at UC Santa Cruz. He and his collaborators have detected a total of 14 of the 20 known planets outside our solar system. Since 1995 Marcy has worked tirelessly with the media and made numerous public appearances on TV, radio, and at lectures communicating the results of his research to general audiences. He is a member of the ASP Board of Directors, the AAS Council and the Fellow of the California Academy of Sciences.

Historical Background

Ruth J. Northcott (1913-1969) joined the staff of the Department of Astronomy, University of Toronto, in 1935 as a Computer. In the early years, she compiled meteor and variable star observations from amateurs and, working with R.E. Williamson, produced the first radio map of the sky in galactic coordinates. But her main research interest was radial velocities and spectroscopic binaries. For years, she taught an introductory astronomy course designed for schoolteachers, and she was responsible for the lab work for the Astronomy students in the department. She took a rare personal interest in her students, photographing her classes, and keeping in touch with many graduates. Within the RASC, she served many roles, including President. She was Assistant Editor, and later Editor, of both the RASC Journal, and the Observer's Handbook. She undertook these duties with the highest possible standard, and brought the circulation of the Handbook to unsurpassed levels. As well as being an astronomer and teacher, she was an accomplished artist and photographer. Her interest in students, teachers, amateur astronomers, and the public was well known and appreciated. It is fitting that she is being honored at a conference on "Partners in Astronomy".

HISTORY SESSIONS

Presented by the ASP History Committee
Medical Science 3153

SUNDAY, JULY 4: AMATEUR CONTRIBUTIONS TO ASTRONOMY

Invited Lectures

9:00 GETTING ORGANIZED: U.S. AMATEUR ASTRONOMY FROM 1860 TO 1985

Thomas R. Williams, Rice University

As interest in astronomy waxed during the second half of the nineteenth century efforts were made to form associations of amateur astronomers. However, it was not until 1911 that the first nationwide organizations for amateur astronomers, the American Association of Variable Star Observers and the American Meteor Society, were founded with the encouragement of professional astronomers. Amateurs whose interests did not include these specialized fields still lacked any organizational focus. After World War I organizing efforts increased with the advent of the amateur telescope making (ATM) movement. Sponsored by Scientific American editor Albert G. Ingalls and ATM patron saint Russell Williams Porter, that movement triggered the founding of a large number of local amateur astronomy clubs. For the next thirty years emphasis in amateur astronomy clubs was primarily on telescope making and astronomy as a recreational activity, though three interesting exceptions to this general observation will be discussed. After World War II, the foundation of several new organizations specifically focused on facilitating scientific observing programs (Association of Lunar and Planetary Observers, International Occultation Timing Association and the International Comet Quarterly) provided broader opportunities for amateurs. The formation and role of the Astronomical League will also be considered.

Tom Williams' interest in the history of astronomy developed out of his life-long avocation as an amateur astronomer. He elected to pursue the history of astronomy in retirement, and he is now a graduate student in history at Rice University. His other astronomical interests have included variable stars and comets. He served as president of the American Association of Variable Star Observers from 1985 to 1987 and again in 1993, and he is currently a member of the ASP History Committee.

9:40 CONFIDENCE AND DEFERENCE: THE ORIGINS AND DEVELOPMENT OF THE RASC

Peter Broughton, Royal Astronomical Society of Canada

From 1868 to the present, the Royal Astronomical Society of Canada has evolved through three phases distinguished by the extent of professional involvement. Examples will illustrate that amateurs and professionals have played symbiotic roles in encouraging, advancing and popularizing astronomy and related sciences.

Peter Broughton, a retired mathematics teacher, is the author of Looking Up : A History of the Royal Astronomical Society of Canada. Educated at the University of Toronto, he has held a number of offices in the RASC, including president in 1992-94.

10:20 BREAK

Speaker Biographies and Abstracts

10:40 PETER MILLMAN'S ARMY: AMATEURS AND PROFESSIONALS IN CANADIAN METEOR PROGRAMMES
Richard A. Jarrell, York University
Canadian professional and amateur astronomers had little contact until the late 1930s, when Millman established a meteor observation program at Toronto. After the war, as one of the world's foremost experts on meteor spectra, he organized an amateur team at the Dominion Observatory and at the National Research Council. This effort was an essential part of Canada's participation in the International Geophysical Year.

Richard A. Jarrell is Professor of Natural Science at York University. Beginning with historical work on 16th-century astronomy (Michael Maestlin), he has been slowly working his way to the 20th century. Apart from numerous articles on history of astronomy (and science in general), he has written The Cold Light of Dawn: A History of Canadian Astronomy. He is a member of the ASP History Committee and chair of the Canadian Astronomical Society's Heritage Committee.

11:20 GROTE REBER: PIONEER OF RADIO ASTRONOMY
Kenneth I. Kellermann, National Radio Astronomy Observatory
Following Karl Jansky's 1933 discovery of cosmic radio emission at Bell Laboratories, for more than a decade, a lone amateur, Grote Reber, exploited the opportunity to observe the Universe through this previously unexplored window. Using his own private resources, Reber designed and built the world's first radio telescope, which he used to map the Galactic radio emission, and to detect radio noise from the sun and the center of the galaxy. Reber understood the nonthermal nature of the Galactic radio noise which changed, in a fundamental way, our view of the universe. Reber's pioneering work was a precursor to the post war discoveries of radio galaxies, quasars, pulsars, gravitational lenses, cosmic masers, the cosmic background radiation, and the first detection of planets beyond the solar system. Probably never before, or since, has a single amateur had such a profound impact on the development of astronomy and astrophysics. In recognition of his pioneering work, Grote Reber was the recipient of the 1962 Bruce Medal of the Astronomical Society of the Pacific as well as the 1962 Russell Lectureship of the American Astronomical Society.

Kenneth Kellermann is a senior scientist at the National Radio Astronomy Observatory headquarters in Charlottesville, VA. His book, Serendipitous Discoveries in Radio Astronomy, which he edited with B. Sheets, provides accounts of the dramatic growth and unexpected discoveries of radio astronomy by those who made it happen.

12:00 BREAK

GENERAL HISTORY OF ASTRONOMY

Invited Lectures

1:30 THE BEGINNINGS OF NAVIGATIONAL ASTRONOMY IN CANADA
Julian A. Smith, School of Liberal Arts, Toronto.

Astronomy in Canada during the 16th-17th centuries was remarkably sophisticated, given the enormous practical and technical problems faced by Renaissance explorers like Jacques Cartier (1491-1557), John Davis (c.1550-1605), Robert Bylot (fl.1610-1616), and Thomas James (1593-1635). Mariners from England, France, Spain and Portugal employed new astronomical instruments and novel techniques to navigate Canadian waters in their search for a passage to Asia; meanwhile, in the interior of the continent, religious orders such as the Recollets and Jesuits carried out highly detailed observations of eclipses, comets and other astronomical phenomena.

Julian A. Smith is the Head of Sciences at Toronto's School of Liberal Arts. Educated at the University of Toronto and at Queen's University, he has written many articles on the history of astronomy and other sciences, along with a book on the history of Canadian medicine entitled William R. Beaumont: Mechanical Genius.

2:10 CANADIAN ASTRONOMERS WITH EARLY HARVARD PH.D.'S
Dorrit Hoffleit, Yale University
Graduate degrees in astronomy were not awarded at Harvard until Harlow Shapley became the director of the Harvard College Observatory. During his regime, 1921-1952, fifty Ph.D. degrees in astronomy were awarded by Harvard or its associated women's college, Radcliffe. The British Cecilia H. Payne was the first to fulfill the requirements. As Harvard steadfastly refused to award any degree to women, Radcliffe came to the rescue and awarded her the degree in 1925. The second under Shapley but the first awarded by Harvard was to the Canadian, Frank S. Hogg, in 1929. The third and fourth went to American women, to Emma T.R. Williams in 1930, and Helen B. Sawyer Hogg in 1931. (In 1930 Miss Sawyer married Frank Hogg, and soon after she obtained her degree, both settled in Canada.) The following year, 1932, an American woman, Carol Anger, and a Canadian, Peter M. Millman, earned the degree. Of the fifty doctorates awarded during Shapley's directorship, fourteen went to women. Two more Canadians were F. Shirley Patterson in 1941 and Donald MacRae in

1943. All those in Canada became successful professional astronomers.

Dorrit Hoffleit worked at Harvard College Observatory from 1929 to 1956. From 1956 to 1978 she served half-time as director of the Maria Mitchell Observatory on Nantucket Island, and half-time at Yale. Many of her projects after official retirement deal with variable stars and the history of 19th and early 20th century astronomy. Author or coauthor of several editions of the Bright Star Catalogue and The General Catalogue of Trigonometric Stellar Parallaxes, her historical books are Women in the History of Variable Star Astronomy, The Education of American Women Astronomers Before 1960, and Astronomy at Yale, 1701-1968. She is a recipient of the American Astronomical Society's Annenberg Prize for outstanding contributions to science education through astronomy and the Nantucket Maria Mitchell Association Women in Science Award. She is a member of the Connecticut Women's Hall of Fame. There is a profile of her in the February 1999 issue of Sky & Telescope.

2:50 BREAK

3:10 THE GREAT INSTRUMENTS OF THE GRUBB TELESCOPE-MAKING DYNASTY

John W. Briggs, Yerkes Observatory, University of Chicago

Thomas Grubb of Ireland, born in 1800, was a talented engineer, and by the early 1830s, an active amateur astronomer with a 9-inch reflector. His first large contract was to mount a 13.3-inch lens, which at the time was the largest in the world, for the Markree Observatory. Thus began an extraordinary telescope making enterprise which, by the end of Grubb Parsons in 1985, had built many of the largest and most important telescopes in the world, including the 74-inch David Dunlap reflector in Toronto. This presentation will illustrate 150 years of achievement by Thomas Grubb, his more famous son Howard, and by Sir Howard Grubb, Parsons, and Company-the firm's later and final incarnation.

John W. Briggs is a research engineer based at the University of Chicago's Yerkes Observatory. In 1994, he served as a winter-over scientist at Amundsen-Scott South Pole Station for the Center for Astrophysical Research in Antarctica, then headquartered at Yerkes, and presently he is deployed at Apache Point Observatory in New Mexico, assisting with the operation of the Sloan Digital Sky Survey. John's favorite hobby is the history of telescopes. He is an enthusiastic member of the Antique Telescope Society, and his collection includes items from small eyepieces to huge equatorials.

3:50 "A SPRING OF WATER IN A DRY AND THIRSTY LAND": WILLIAM HUGGINS AND THE ORIGINS OF ASTROPHYSICS

Barbara Becker, WestEd and University of California, Irvine

In the mid-nineteenth century, a small group of chemists, physicists, and amateur astronomers adapted the spectroscope in order to analyze the light coming from celestial bodies. Their efforts gave birth to a hybrid science which they called the "new" astronomy, astronomical physics, or astrophysics. William Huggins (1824-1910), an English amateur astronomer, was recognized in his own lifetime as one of the principal founders of this new science. Late in life, he provided us with a published account of his pioneering efforts that shaped how we view the origins of astrophysics. This paper presents a more complex and interesting portrait of this self-styled pioneer based on new information that has come to light through examination of his observatory notebooks and his extensive correspondence.

At WestEd (formerly Southwest Regional Laboratory), Barbara Becker is developing a new and innovative physical science curriculum, based on episodes in the history of science, for students in grades 8-10. Also an adjunct assistant professor of history at the University of California, Irvine, she wrote her doctoral dissertation in the history of science on William and Margaret Huggins.

FUTURE DATES FOR MEETINGS

(Put them on your calendar!)

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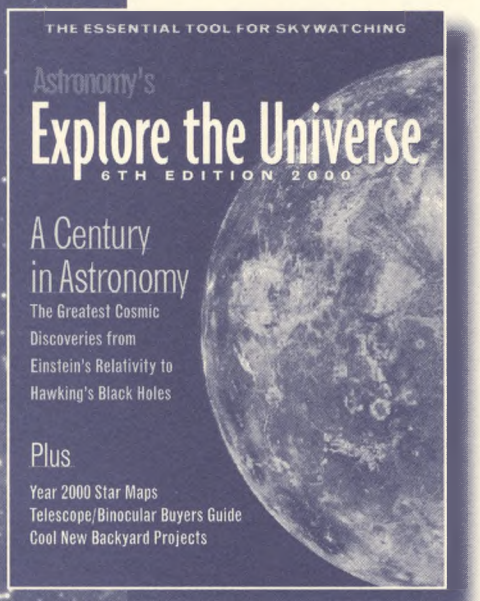

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