



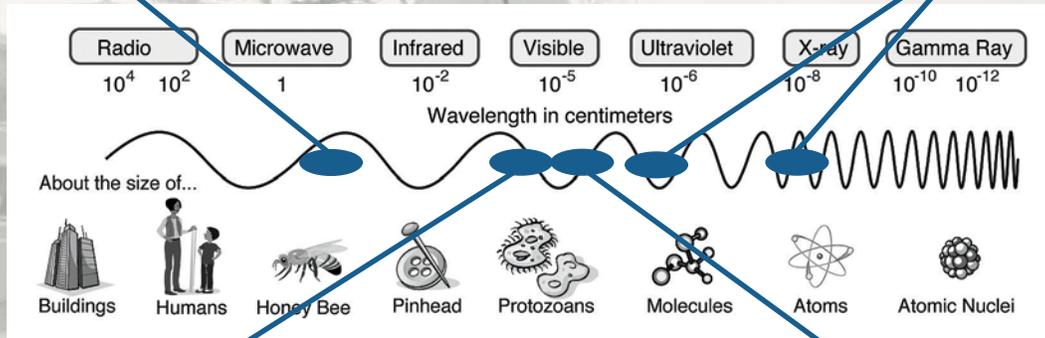
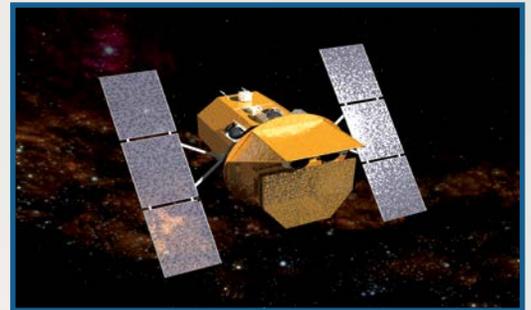
Michigan Astronomy News

FOR ALUMNI & FRIENDS OF THE UNIVERSITY OF MICHIGAN ASTRONOMY DEPARTMENT

NOEMA



SWIFT



MDM



MAGELLAN



Letter From The Chair

It has been an great start to my first year as the chair of the astronomy department. We have a wonderful department, college, and university for which I am honored to serve as the astronomy chair. To me there are some important

changes, in both our critical personnel and telescopes, that really are pushing our department, and the opportunities for our students, into new and exciting directions.

Over the past several years we have added four new faculty members that have joined the department: Prof. Keren Sharon, Prof. Kayhan Gultekin, Prof. Emily Rauscher, and Prof. Michael Meyer. All of these individuals are world-class scientists who will enhance our department with scientific scholarship and leadership.

These new faculty, and the rest of our department, also have greater access to telescope facilities than ever before. Telescopes are our laboratories. Today astronomers seek to characterize and understand the universe and the objects within it using as much information as possible — and this includes observing wavelengths that are hidden to human eyes. To facilitate these efforts our department has signed agreements with NASA's Swift satellite and the Institut de RadioAstronomie de Milimétrique (IRAM) in Grenoble, France. Swift can observe

the X-rays and Ultraviolet light emitted by black holes as they swallow surrounding matter and release bursts of energy, while the IRAM telescopes trace the cold universe where the light from young stars, planet-forming disks, and galaxies during the age of peak star formation can be found. With these new facilities Michigan Astronomy stands out when compared to nearly all our competitors in our ability to probe and characterize astronomical objects across a significant portion of light's spectrum. One of the reasons we can accomplish all of these endeavors is due to the great support our University, the College of Literature, Science, and the Arts, and the Astronomy Department has from our Alumni. So thank you!

Looking forward to the coming year our department is very excited to host Dr. Jocelyn Bell-Burnell, as the Mohler Prize Winner (see p. 7). Another event of note is the annual star party in Arizona where we put eye pieces on our two telescopes at the MDM observatory. This event has been quite amazing — even to this seasoned astronomer. We are happy to announce that this year for our star party on April 2, we will be joined by the Andrew Martin, the Dean of the College of Literature, Science, and the Arts.

As always you are welcome to stop by and see our new home in West Hall, come to the Mohler lecture and learn from one of the best, or see the stars at one of our observatory nights on the top of Angell Hall run by our active and engaged student astronomical society.

—Ted Bergin



The North Polar Region. Based on images of the Moon taken before the first lunar landings, this work, created in 2004 by Prof. Sherri Smith of the Stamps School of Art & Design, hung in the 3rd floor entrance to the department during the last academic year. Another work also woven in strips using torn cotton cloth and fine yarn, based on images of the moon Titan, is now on display. (Photo Credit: S. Smith.)

Department of Astronomy Fast-Facts

People

- 25 Tenure-track Faculty (4 are within Physics & History)
- 9 Research Scientist/Professor Faculty
- 3 Emeritus Faculty
- 12 Postdoctoral Fellows and Research Associates
- 26 Graduate Students
- 6 Administrative and Technical Staff
- 35 Undergraduate majors and minors

Computing

- University-wide Flux cluster, with approximately 19,000 cores, InfiniBand network, and 1.5 PB scratch storage.

Observatories

- Magellan Telescopes: 2 x 6.5-m telescopes at the Las Campanas Observatory, Chile
- MDM Observatory: a 1.3 and 2.4-m telescope on Kitt Peak, Arizona
- Curtis-Schmidt telescope at the Cerro Tololo Inter-American Observatory, Chile
- CHARA optical/infrared interferometer on Mount Wilson, California
- Angell Hall student telescopes and planetarium, and Detroit Observatory Fitz telescope, on Main Campus

News From West Hall

We have been in West Hall for over one year. Some redesign of office space is in progress, but the cinder-block walls and exposed pipes of Dennison Building are a fading memory, and visitors continue to be awed by the grandeur of our new meeting room — aptly named Pavo, following the department’s avian constellation theme for room names.



Undergraduate News

The class of 2015 included James Kakos, Amy Edwards, Sierra Grant (who has gone on to do graduate work at Boston University), Christina Seely, Nicholas Kern (who has gone on to do graduate work at the University of California, Berkeley), Ezekiel Silverstein, Daniel Kaplan, Caleb Abbott, Sean Lemons, Vaughn Liendo, Emily Dingwell, Stephen Schlaeflin, Alyssa Keimach, and Faith Vowler. We started the 2015-6 academic year with 35 majors, the undergraduate program strengthening each year.

Graduate Student News

Ilse Cleeves (advisor Prof. Ted Bergin) defended “Molecular Signposts of the Physics and Chemistry of Planet Formation” on April 29th. In this work, she studied the spatial and temporal nature of ionizing processes in protoplanetary disks around young, active stars, and predicted how we can use emission from molecular ions to ‘map out’ the disk’s internal ionization structure. Applying these results to Submillimeter Array data, she measured the lowest known limit on cosmic ray ionization within a disk, suggesting the presence of natal magnetic fields or winds shielding the planet-forming environment. Ilse received a Hubble Fellowship, which she is taking at the Smithsonian Astrophysical Observatory.

Colin Slater (advisor Prof. Eric Bell) defended “Satellite Quenching and the Lifecycle of Dwarf Galaxies” on June 23rd. Colin presented the discovery and characterization of two dwarf galaxies, and tested physical models for

The 2015 Undergraduate Poster Session in Pavo, organized by Andrea Carrillo, Prof. Nuria Calvet and Prof. Ted Bergin. Nicholas Kern won the award of best poster, for his work with Prof. Chris Miller and graduate student Dan Gifford on the mass-richness relationship for galaxy clusters. (Photo Credit: S. Murphy.)

the processes that shut off star formation in dwarf satellites. Colin has moved to the University of Washington to work in the Survey Science Group on the scientific development of the LSST (Large Synoptic Survey Telescope).

Postdoc News

Dr. Sarah Loebman was selected by the Rackham Office of Postdoctoral Studies for a 2015 Outstanding Postdoctoral Fellow Award.

Faculty News



Prof. Jon Miller received a Faculty Recognition Award. No more than five such awards are made each year, and they recognize nominees who “at mid-career have made outstanding achievements in scholarly research and/or creative work, demonstrated excellence as a teacher and mentor, and have served the University as a conscientious and engaged citizen of their department, school or college”.



Prof. Eric Bell has won the John Dewey Award. Award recipients are selected each year by the LSA college Executive Committee from amongst those recommended for promotion from associate professor to full professor with tenure, for demonstrating long-term commitment to the education of undergraduate students.

Cover Image: The extraordinary waveband coverage now available to the department’s observers; see p. 5. (Photo Credits: Bentley Historical Library, University of Michi-

gan; NASA; NOAO; IRAM; Carnegie Observatories/Chris Burns.)

Newsletter Production: P. Hughes



A workshop titled *Frontiers in Star Formation* was held June 18-19, to celebrate the contributions of **Prof. Nuria Calvet** and **Prof. Lee Hartmann** to the field. Almost 50 participants, including a number of former graduate students, contributed on the topics of T-Tauri stars; Disks & Dust; Molecular Cloud Theory & Simulations; Outflows, Jets, Shocks & Winds; Accretion Disk Theory & Simulations and Star Forming Regions. This reflects the extraordinary breadth and depth of impact that Nuria and Lee have had in the field of star formation.



Prof. Michael Meyer, from ETH Zurich will be joining the department as full professor in 2016. He is currently using both photometry and spectroscopy in the infrared to characterize stellar mass distributions, to determine whether the distribution of stellar masses is fixed by a self-regulating process, or the initial conditions of star formation in a given environment. His interests also include the physics and time scale for dissipation of the circumstellar disks that are the precursors of planetary systems, and the origin, evolution and prevalence of life in the Universe. His presence will complement the department's expertise in observational astronomy from the sub-millimeter to the far-ultraviolet, and strengthen the department's dynamic exoplanet and planet formation group.



Dr. Kayhan Gultekin, who has been a research scientist in the department for a number of years, will take up an assistant professor position at the start of 2016. He is interested in accretion onto, the evolution of, and feed back from black holes across the entire range of scales, from stellar mass objects to the supermassive black holes in galactic nuclei. He has used theoretical studies and observations across the entire electromagnetic spectrum to explore whether the same physical processes are at play from stellar remnants to active galaxies.



Alumni News

Dr. Xiao Che's 2014 thesis, "Near-infrared View of Stellar Surfaces and Circumstellar Disks with an Upgraded Optical Interferometer", has won a Proquest Dissertation Award. Only about 1% of University of Michigan theses receive this prestigious award, and this is the 2nd for the department in recent years!

Dr. Ashley King's 2014 thesis, "Accretion Driven Out-

flows from Black Holes Across the Mass Scale", has won the 2015 Ralph B. Balwin Prize in Astrophysics and Space Sciences.

Dr. Jessica Werk, who received her PhD from the department in 2010, and currently holds a Hubble Fellow at Santa Cruz, takes up the position of Assistant Professor at the University of Washington in March 2016.

Shannon Murphy

In celebration of **Shannon Murphy's** decade of



service to the department, she presented a lecture titled "Annals and Auguries of Michigan Astronomy: A Perspective on How Things Have Changed and How They May Be Changing", on December 10, 2014.

She came to the department highly recommended from her time at Eastern Michigan University, and Washtenaw Community College. With the additional benefit of her links to the amateur astronomy community, the department had high hopes that she would make a significant contribution to undergraduate teaching. Little did the department realize how indispensable she would become!

She uses a wealth of experience in small telescope use and repair, the programming and operation of our planetarium's Zeiss projector, and in website and curriculum development, to support faculty and undergraduate instructors, maintain facilities, web sites, and a presence on social media, and act as coordinator for the outreach program. The department without Shannon is unimaginable.

International Relations



Prof. Mario Mateo explaining the operation and goals of the Michigan/Magellan Fiber System to U.S. Ambassador to Chile Hammer at Las Campanas Observatory in May 2015. Ambassador Hammer was treated to a detailed tour of the Magellan telescopes and support facilities. He had many questions about the observatory and M2FS, including "Why does the instrument have black artificial grass on it?" (Contact mmateo@umich.edu for the scoop!) He was visiting various US-run observatories in Northern Chile prior to his attendance at the ground-breaking for the LSST project at Cerro Pachon. (Photo Credit: C. Nyce.)

Telescopes Large And Small

The background of the front cover shows the Detroit Observatory c.1921, in a photograph by Robert George Swain, looking over E. Ann St. How the facilities available to the department's observers have changed, particularly in the last few years! As well as access to MDM and Magellan, we now have time on both NOEMA and Swift (see p. 6). Coupled with successful proposals to facilities such as Chandra, HST, Spitzer and the VLA/VLBA, our window on the Universe spans the electromagnetic spectrum.

In such an environment, the training of students is critical, and **Prof. Sally Oey** continues to lead

this effort with ASTRO 461: "Ground-Based Observatories". This is an immersion course held in residence at Kitt Peak National Observatory in Arizona. Students get to explore a variety of telescopes and instrumentation, and use the MDM telescopes to carry out small science projects. The photos are from last summer's course. In the left image the students are seen with Prof. Oey (far left) and Provost Martha Pollock (third from right); in the image below, the class examine the freshly realuminized MDM 2.4-m mirror. (Photo Credits: S. Oey.)



In 2000 the department was one of the first institutions to purchase a SRT (**Small Radio Telescope**) from Haystack Observatory. After a modest amount of construction, first light was achieved in March 2001, by **Prof. Hugh Aller**, **George Latimer** (Research Project Engineer) and **Dr. Tim Paglione** (Lecturer), mapping the disk of the Sun. It played a significant role in undergraduate teaching, primarily mapping the Galactic rotation through measurement of the 21cm line of HI. However, after many years on the roof of Angell Hall a succession of mechanical and electronic failures made the instrument unusable.

Haystack no longer supply the SRT in "kit" form, but **Dr. Alan Rogers** has provided extensive plans for the construction of such an instrument from scratch. **Prof. Carl Akerlof** (Physics) has led a project to replace the old SRT based on these plans, using only the dish and mount plinth from the original setup. This came to fruition in 2015, and in August

Prof. Akerlof and **Dr. Philip Hughes** (Research Scientist) offered an ALPhA (Advanced Laboratory Physics Association) *Immersion*. The immersion is designed to provide a small group with intensive, hands-on experience with an advanced laboratory experiment, giving the participants enough experience to build and use the experiment with confidence in their own teaching. The instrument will now be used in teaching ASTRO 361: *Astronomical Techniques*, PHYSICS 441/2: *Advanced Labs*, amongst other classes, and in outreach.



Yuriy Bomze (Duke University), Philip Hughes, Marcus Alfred (Howard University) and Alan Rogers (Haystack Obs.) on the roof of Angell Hall. during the Immersion (Photo Credit: C. Akerlof.)

NOEMA, Swift & MIRA

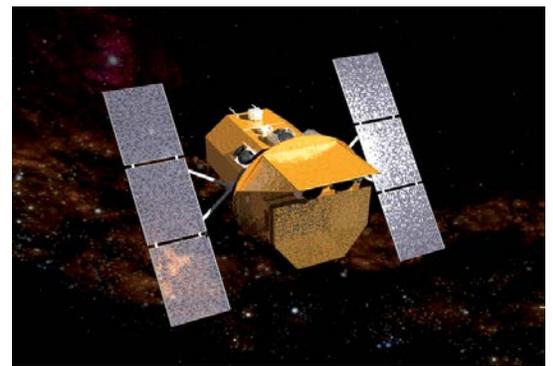
Dr. Kayhan Gultekin will chair the department's internal review committee for proposals, now that we have signed into an agreement allowing access to the NOEMA Interferometer, located on the Plateau de Bure in the French Alps at an altitude of 2550 meters. NOEMA (the NOthern Extended Millimeter Array), considered the best millimeter array in the northern hemisphere, consists of seven dishes – plus more on the way – operating in tandem to produce sharp images and take detailed spectra of a variety of astrophysical objects between wavelengths of 0.8 and 3 mm. In exchange for €1 million, the department will enjoy 500 hours of NOEMA time over the next 5 years, during which time it is expected to learn about the chemistry and physics of planet formation, measure the gas content of galaxies in the distant Universe, and unlock the secrets of how matter flows towards and gets thrown away from black holes.



Some of the 15 meter dishes of NOEMA on Plateau de Bure in the French Alps. The antennas have a maximum separation of 760 meters. (Photo Credit: IRAM.)

Prof. Jon Miller lead an initiative to purchase 1 Msec/year, over a three year period, of time on Swift, and he continues to oversee and advise the proposal submission process. As with NOEMA, there is an internal review committee, and that review takes account of the deadlines for both Chandra and Hubble proposals, in order to maximize the benefit of multi-instrument projects. Consideration of the first round of proposals started in Spring 2014, with another cycle in the Fall. The first round of approved programs was incredibly diverse: subjects included black holes, neutron stars, clusters of galaxies, normal galaxies, Kepler stars, and even star-planet interactions. Some programs were focused on X-ray data, while other focused on the optical-UV band. There were also numerous multi-instrument programs, with Swift observations paired with others using the Hubble Space Telescope, the Chandra X-ray Observatory, and the Very Large Array.

An artist's view of Swift, which comprises three telescopes: the BAT, XRT (sensitive to 10 keV), and UVOT (sensitive to 170 nm). (Photo Credit: NASA.)



Prof. Eric Bell, director, reports a productive year for the Michigan Institute for Research in Astrophysics (MIRA). The largest meeting this year was an international Local Group Astrostatistics conference, held June 1-4 (see photo, back cover). Involving over 100 participants from all over the world, the scientific focus was astrophysical exploitation of statistics for understanding the Milky Way, the Andromeda galaxy and their satellite galaxies. In the afternoons, renowned experts held workshops training participants in statistical and computational techniques particularly important for astrophysics. This twin conference/workshop focus is novel, helped train Michigan astrophysicists (in particular undergraduates and graduate students), and was very well received.

A particular highlight for the institute is a discussion series on women and minorities in astrophysics. Like many of the physical sciences, the community of astrophysicists does not reflect the demographics of the wider population, representing an ethical and practical challenge — many potentially outstanding scholars are

not being encouraged to develop their interest and skills. This series of events brings MIRA astrophysicists together to discuss issues that affect the climate for women and minorities (including racial, ethnic, sexual orientation, learning and physical disability issues) and to envisage ways to improve the communication, support and thereby climate. A number of new initiatives have resulted from these discussions — an important step forwards for the University of Michigan.

In addition, MIRA hosted a fruitful workshop on connections between the study of the Sun and stars on May 18-19, and on September 21-22 hosted, and joint supported with the Michigan Institute for Theoretical Astrophysics and the Kavli Center for Cosmological Physics in Chicago, a meeting charting out the next steps for the investigation of the cosmic microwave background — a uniquely powerful probe of the conditions in the very early Universe and the fundamental physics of matter and energy at the very highest energy scales.

A Sense Of History

The impressive waveband coverage available to the department's observers as the University approaches its bicentennial in 2017 prompts a look back to a time half a century ago when Chile saw the first large southern hemisphere telescopes constructed. The Optical Society of America had a newly formed Ann Arbor section, and in celebration of this, in 1967 an "Optical Frontiers" symposium was held, at which **Prof. Orren Mohler**, then Chairman of the Astronomy Department, gave a talk on recent developments in Chile, and the bright future for observations of the southern skies, in particular the Magellanic



Orren Mohler (left) with John M. Randall from Ohio State, at the 1967 Optical Frontiers symposium. (Photo copyright The Optical Society.)

clouds. Mohler was a noted observer: he was director of the McMath-Hulbert Observatory from 1961 to 1970, and his research led to the construction of the first astronomical vacuum spectrograph.

Just 6000 km away, at the Mullard Radio Astronomy Observatory of the University of Cambridge, **Jocelyn Bell**, who had recently graduated from the University



Jocelyn Bell, one year after the discovery of pulsars in 1967. (Photo copyright Daily Herald Archive/National Media Museum/Science & Society Picture Library.)

of Glasgow, was a graduate student working with Profs. Antony Hewish and Martin Ryle; they hoped to use interplanetary scintillation in studying quasars. The serendipitous discovery of the first pulsar in 1967 is a much told story. She has devoted her career to the study of pulsars and compact objects, and is the recipient of many awards and honorary degrees.

The recipient of the 2016 Orren C. Mohler Prize, awarded for excellence in research in astronomy and astrophysics, is Prof. Jocelyn Bell-Burnell,

now a Visiting Professor at the University of Oxford. Prof. Bell-Burnell's Mohler Prize colloquium will be on March 29, 2016, with a public lecture on March 30.

What can be more personally satisfying than completing a physically challenging activity? And what's more awe-inspiring than a total Solar eclipse? Well, here's your chance to combine both into an unforgettable adventure!

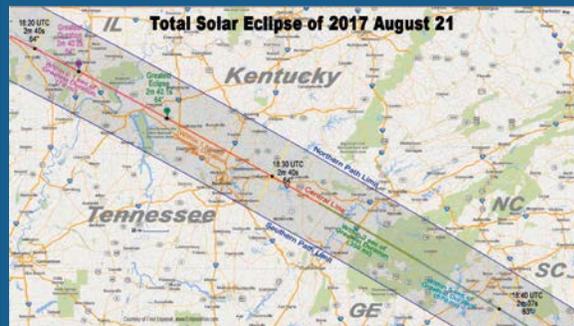
On August 21, 2017, the shadow of the Moon will cross the continental United States, offering a coast-to-coast opportunity for millions of Americans to see a total Solar eclipse in person. As readers of this newsletter may recall, **Prof. Mario Mateo** is an avid cyclist and he's already planning to take this unique opportunity as a great excuse to bike from Ann Arbor across a few states to see totality, his third trip to see a total Solar eclipse.



Are you interested in coming along? The nearest point on the eclipse path to Ann Arbor is in Kentucky, coincidentally very close to the point where totality has its maximum duration. That's about 550 miles of rolling, but downhill — well, from 950 ft to 300 ft! — terrain on back country roads of Michigan, Ohio, Indiana and Kentucky. This tour promises to be a great way for 10-20 friends of the UM Astronomy Department to spend 7-10 days sharing an exciting and challenging adventure to see one of the most awesome events Nature has to offer. And, there will be some astronomers on-board — well, at least one biking and a few supporting the trip — who can talk about eclipses and other astronomical topics during some of our group dinners. And there will be a *lot* of eating going on!

Mario and son Emilio, who graduated from UM last year, at Old Faithful Geysers.

If this sounds like an adventure you might be interested in participating in, or you just want to learn a bit more, please contact Prof. Mateo via email (mmateo@umich.edu) by February 2016. At that point, he should have an idea if



(Photo Credit: F. Espenak.)

there is sufficient interest to organize a fully-supported bike tour to the Moon's Shadow in August 2017.

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311 West Hall
1085 S. University Ave.
Ann Arbor, MI 48109-1107



of Michigan's Student Astronomical Society hosted the viewing event, and brought an Orion 6-inch XTi, a Celestron 8-inch SCT, and a long-focal length refractor. Others brought binoculars. Many people successfully photographed the eclipse with their cell phones through telescopes, although the moon was very dark at totality. The images show viewing the eclipse from central campus, the Moon leaving the umbral shadow over the Michigan Union, and the Moon near total eclipse. (Photo Credits: D. Ma.)

On Sunday, September 27th, 2015, well over one hundred students, faculty, and community members watched the total supermoon lunar eclipse. The University



Participants in the 1-4 June 2015 Local Group Astrostatistics Conference. (Photo Credit: C.Israel.)

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