

Kai'aleleiaaka THE MILKY WAY

Issue 9  13 August 2015

Wally Pacholka / AstroPics.com

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The Laniakea Supercluster of Galaxies

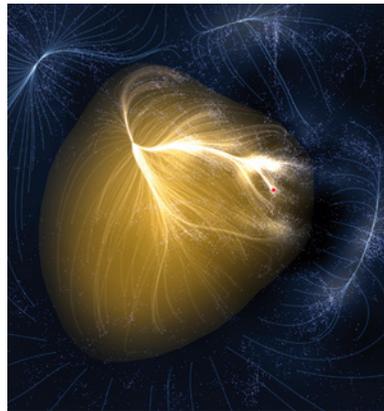
By BRENT TULLY

Astronomy has a special fascination for people. Our introduction of the name Laniakea Supercluster of Galaxies ([published in Nature](#)) for the structure that we live in, has generated a wonderful example that merits reflection.

Any professional astronomer who has spent time with the amateur astronomy community is familiar with their enthusiasm. We can be amazed at their willingness to endure cold nights to repeatedly observe familiar objects in our dark sky. This fascination for dark skies is primeval; our ancestors became acquainted with patterns in the fields of stars. Names were given to the patterns as well as to individual objects — it is part of familiarization.

People have names, and these names are an important part of how we relate to each other. Pets get names, as distinct from animals we eat. Naming is more than superficial; it is part of the process toward physical comprehension. A named entity acquires form in our minds. A named object may be categorized and distinguished. The act of naming invites an appreciation for complexity.

We humans are still only taking our first baby steps in our exploration of the universe. Through remarkable efforts we have left footprints and tire tracks on other worlds. Our robots' eyes return up-close images of places



This visualization of a slice of the Laniakea supercluster shows individual galaxies as white dots and their movement by white threads. The region contains 100 million billion stars. [Mark A. Garlick]

throughout our solar system. Looking further, we know that other solar systems are totally common, though rich in individual complexity. We appreciate that just within our Milky Way galaxy, the planet count could reach a trillion.

How ignorant we are! What's happening in all those other galaxies? For the moment our questions are simpler. Why are galaxies big and small, old and young, organized and shredded, mostly in packs but sometimes living as hermits? Even with our provisional forays, we can identify structures at high redshift. We speak of emergent clusters, filaments, sheets, and voids. The simulations look beautiful. It is too bad that our real world renditions of cosmic structure don't look as great.

But we are doing better. We astronomers are explorers. We report back to the public what we find. That picture is not the one given by Hollywood. Our story purports to be factual, and to varying degrees we are successful at being heard on the street. People want to know



Kai'aleleiaika THE MILKY WAY

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Invited Discourse 4: The Laniakea Supercluster of Galaxies	
Speaker	Brent Tully (Institute for Astronomy, University of Hawai'i)
Date	Thursday, 13 August
Time	6:00 to 6:45 pm
Location	Ballroom B, Hawai'i Convention Center

where we live because it is part of the larger question of why.

INVITED DISCOURSE 5

A Unique Probe of Molecular Gas in the Milky Way and Beyond

By THOMAS R. GEBALLE

Research in astronomy includes events encompassing a vast range of time intervals, from those occurring during incomprehensibly small fractions of a second to those taking billions of years and more. It also encompasses phenomena critical to the characteristics of the universe on a vast range of physical sizes, from the scale of the entire universe down to molecules, atoms, and subatomic particles.



In the field of interstellar gas phase chemistry, a critical role is played by the triatomic hydrogen ion, H_3^+ — the smallest and simplest polyatomic molecule. It is fair to say that H_3^+ (three protons and two electrons) is the starting point of reaction chains that result in the production of many of the molecular species observed in interstellar clouds.

In my talk, I will discuss the scientific history of this fascinating ion, including: a discussion of the discovery of H_3^+ in the laboratory over a century ago; our appreciation of its critical role in gas phase chemistry — which occurred long before it had

The very nice [video](#) created by the people at *Nature* magazine synthesized our article on Laniakea in a way that has attracted more than three million viewers. Among the many messages afterward was one from a young boy who said that what he learned made him so happy that he cried. 🌸

BRENT TULLY has worked as an astronomer at the Institute for Astronomy, University of Hawai'i, since 1975. He specializes in observational extragalactic astronomy, or what he calls “cosmology up close.”

been found in space and, in fact, before its spectrum had been observed in the laboratory; and its discovery in space; our realization that measurements of H_3^+ reveal crucial information about interstellar environments that cannot be easily learned in other ways.

I will also discuss key roles played by H_3^+ in interstellar clouds. For instance, it is created wherever molecular hydrogen and cosmic rays

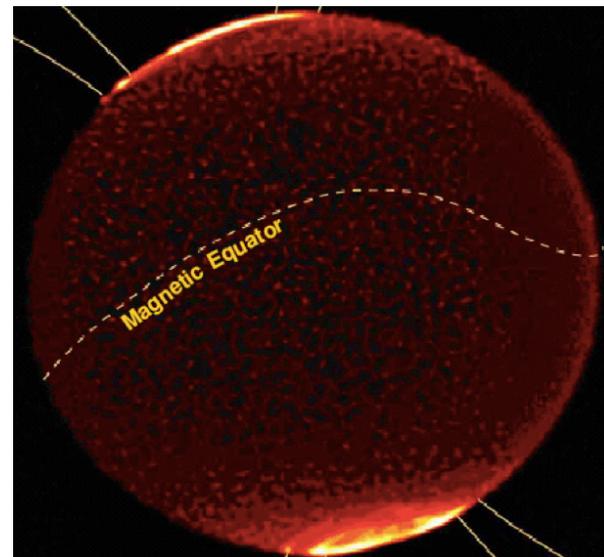


Image of Jupiter at 3.4 microns. Bright auroral line emission from H_3^+ is seen against the planetary disk, which is dark due to absorption of incident sunlight by methane. Magnetic field lines are shown. [NASA IRTF, NSFCam]

**Invited Discourse 5 – Spectroscopy of H_3^+ :
A Unique Probe of Molecular Gas in the Milky Way and Beyond**

Speaker	Thomas R. Geballe (Gemini Observatory)
Date	Thursday, 13 August
Time	6:45 to 7:30 pm
Location	Ballroom B, Hawai'i Convention Center

are both present. In other words, it is created in both dense *and* diffuse clouds. It is also intrinsically stable; H_3^+ is as tightly bound as molecular hydrogen. Further, it is extremely reactive; H_3^+ loves to give its extra proton to almost any atom or molecule it encounters. Cosmic H_3^+ also has a distinguishing ion-molecule chemistry feature: unlike here on Earth, there is no energy barrier to prevent H_3^+ from reacting with other species it encounters.

Other topics of interest related to H_3^+ that I will be discussing are that spectroscopy of H_3^+ is providing constraints on the spectrum of low energy cosmic rays in the galaxy. This has resulted in

the discovery of an important, but previously unrecognized, gaseous environment at the center of the Milky Way. Spectroscopy of H_3^+ is also beginning to provide unique information on interstellar gas in external galaxies.

Additional H_3^+ topics I will discuss include findings that show H_3^+ is the dominant infrared line emitter in the aurorae of three of the four gas giant planets in the solar system. H_3^+ is also expected to produce bright line emission in the upper atmospheres of giant exoplanets located close to their stars. On a more cosmic scale, H_3^+ may be important in the formation of stars in the early, metal-free universe. Thus, future astronomical research utilizing the unique properties of this simple molecular ion is destined to contribute significantly to our knowledge in a wide range of areas. ❀

TOM GEBALLE is an astronomer at the [Gemini Observatory](#). Before joining Gemini, he had been Astronomer-in-Charge, Associate Director, and Head of Operations at the [United Kingdom Infrared Telescope](#).

The IAU Executive Committee for 2015–2018

By RICK FIENBERG, *Kai'aleleika*

The [IAU Executive Committee](#) consists of the President, President-Elect, six Vice-Presidents, the General Secretary, and the Assistant General Secretary, all of whom are elected by the General Assembly on the recommendation of the [Special Nominating Committee](#). The Executive Committee is supported by two Advisors: the Past President and Past General Secretary.

The Officers of the Union are the President, President-Elect, General Secretary, and Assistant General Secretary. They decide short-term policy issues within the general policies of the Union as decided by the General Assembly and interpreted by the Executive Committee.

At the second Business Meeting of the XXIX General

Assembly on Thursday, 13 August, representatives of the National Members will vote to elect the following slate of new Officers for the 2015–2018 triennium, as reported at the first Business Meeting last Tuesday:

- President-Elect: **Ewine F. van Dishoeck** (Netherlands)
- Assistant General Secretary: **Maria Teresa V. T. Lago** (Portugal)
- Vice-Presidents: **Debra M. Elmegreen** (USA), **Ajit K. Kembhavi** (India) & **Boris M. Shustov** (Russian Federation)

Here are the other changes that will occur on the Executive Committee:

- **Silvia Torres-Peimbert** (Mexico) will become President, suc-

ceeding **Norio Kaifu** (Japan), who will become Past President (Advisor).

- **Piero Benvenuti** (Italy) will become General Secretary, succeeding **Thierry Montmerle** (France), who will become Past General Secretary (Advisor).
- **Renée C. Kraan-Korteweg** (South Africa), **Xiaowei Liu** (China), and **Dina K. Prialnik** (Israel) will continue as Vice-Presidents.
- Current Past President **Robert Williams** (USA), current Past General Secretary **Ian F. Corbett** (United Kingdom), and current Advisor **George K. Miley** will rotate off the Executive

Committee, as will current Vice-Presidents **Matthew Colless** (Australia), **Jan Palouš** (Czech Republic), and **Marta G. Rovira** (Argentina).

We owe a huge debt of gratitude to all the officers who have served the IAU during the triennium just ending as well as to those who will continue to serve, or commence their service, during the triennium upon which we now embark. Thanks, too, go to the members of the Special Nominating Committee, who have, once again, come up with a slate of extraordinarily capable and dedicated new Officers. 🌸



Ewine F. van Dishoeck



Maria Teresa V. T. Lago



Debra M. Elmegreen



Ajit K. Kembhavi



Boris M. Shustov



Silvia Torres-Peimbert



Norio Kaifu



Piero Benvenuti



Thierry Montmerle



Renée C. Kraan-Korteweg



Xiaowei Liu



Dina K. Prialnik



Robert Williams



Ian F. Corbett



George K. Miley



Matthew Colless



Jan Palouš



Marta G. Rovira

The Role of the IAU in the Development of Worldwide Astronomy

Thoughts from the President-Elect.

By SILVIA TORRES-PEIMBERT

In 2019 the IAU will celebrate its 100th anniversary! The IAU is very special and different from other international scientific organizations in that it is composed primarily of individual members rather than federations of national disciplinary societies. The IAU currently has 9,251 individual members, with 11,269 members in total. This total number will increase to 12,458 by the conclusion of this IAU General Assembly.

The IAU has always contributed significantly to the overall

development of astronomy worldwide: It has provided a forum to exchange ideas and to develop joint international ventures in research and instrumentation; established multiple ways for astronomers in different parts of the world to collaborate; and simplified communication within the community by adopting many astronomically-related definitions during the General Assemblies, such as boundaries of the constellations, time determinations, astronomical standards, and the naming of new

objects and features.

The backbone of the IAU is its [Divisions, Commissions, and Working Groups](#). The recent restructuring of these bodies was necessary to keep up with advances of our science. In the following triennium we will need to adjust to the new distribution of Commissions and Working Groups to enhance the astronomical activities of our organization.

Customarily the IAU meets in General Assemblies every three years. Additionally the IAU has offered a very successful variety of meetings based on specific astronomy themes, including 320 symposia, 200 colloquia, and 41 regional meetings around the globe. The scientific organizing committees and invited speakers of these meetings have had broad international representation. Symposia sites have been widely distributed around the globe, and this practice of international inclusion will continue in the future. For example, the [2016 IAU symposium](#) will take place in Spain, Australia, Slovenia, Italy, Germany, Colombia, China, Brazil, New Zealand, and France. The [proceedings](#) of all the IAU meetings have been seminal publications for the development of astronomy.

The IAU has triggered many multinational adventures in modern astronomical activities. For example, it provided the framework for creating the Latin American Regional IAU Meetings (LARIM), which have led to many collaborations in different areas of astronomy. Since 1978 there have been 14 LARIM, with host countries including Argentina, Brazil, Chile, Mexico, Venezuela, and Uruguay. [LARIM 2016](#) will take place in Colombia, South America — a country that we will welcome as an IAU member at the end of this General Assembly.

Educational activities are also essential to the IAU. The [IAU International Schools for Young Astronomers \(ISYA\)](#) was established in 1967 and now has an office in Oslo, Norway. To date, there have been 36 ISYAs held all over the world. The



Fond Memories of Past General Assemblies

I still fondly remember the first IAU General Assembly that I attended. It was during the XIV General Assembly in Brighton, U.K., in 1970, where I met Martin Schwarzschild for the second time. He gave a very exciting lecture on stellar evolution in a session organized by Commission 35, Stellar Constitution.

Through the years, I have been very excited to attend subsequent General Assemblies in different places around the world. For each one I have a special memory that I cherish. At the XVIII General Assembly in 1982 in Patras, Greece, I recall hearing Yakov Zel'dovich deliver his invited talk, "Remarks on the Structure of the Universe." I also remember my unhappiness for trying to attend simultaneous sessions of my academic interest at the XVI General Assembly in 1976 in Grenoble, France. Since then, I have become more composed in accepting the inevitable: I cannot be present at several simultaneous sessions. In any case, on that occasion an IAU Resolution on basic principles for planetary-system nomenclature was adopted, including that "nomenclature is a tool, and the first consideration shall be to make it simple, clear, and unambiguous." At the XXI General Assembly in 1991 in Buenos Aires, Argentina, the first Resolutions were accepted regarding reference systems and time scales related to general relativity. I also recall Blair Savage presenting the first results on the unexpected (at least to me) ultraviolet absorption lines of the hot, low-density galactic corona at the XVII General Assembly in 1979 in Montreal, Canada.

The core of General Assembly activities are the scientific and organizational aspects; these are complemented by the interaction with old friends and new acquaintances, as well as by the beauty of the different locations. For example, attending the General Assemblies enabled me to have exciting visits to the various gardens in Nara, Japan; the Beijing Ancient Observatory in China; the Oracle at Delphi in Greece, close to Patras; and, of course, the natural beauty of O'ahu. All of these additional attractions enhance the impact of all IAU General Assemblies.



A performance of the Chinese Long Ribbon Dance during the Opening Ceremony of the XXVIII IAU General Assembly in 2012 in Beijing, China. [IAU, CNCC]

[International Year of Astronomy 2009](#) was an important stimulus for the education activities of the IAU. Thus the [IAU Astronomy for Development Strategic Plan 2010-2020](#) was established, and this project gave rise to the dynamic [IAU Office of Astronomy for Development \(OAD\)](#) in Cape Town, South Africa. The IAU OAD has sponsored many noteworthy astronomical activities. Similarly, the [IAU Office for Astronomy Outreach \(OAO\)](#), in Tokyo, Japan, is carrying out important work in establishing contacts throughout the community of amateur astronomers.

Throughout its rich history, the role of the IAU has been out-

standing in the development of worldwide astronomy, and our goal is to continue along this path. ❁

SILVIA TORRES-PEIMBERT is President-Elect of the IAU. Additionally, she is a member and former Director of the Astronomy Institute of the National Autonomous University of Mexico (UNAM). She has received the highest honors from UNAM and from the Mexican Government, was honored with the 2011 L'Oréal-UNESCO Award for Women in Science, and received the American Physical Society's 2012 Hans A. Bethe Prize in 2012 jointly with Manuel Peimbert.

FOCUS MEETING 20

Developments in the Office of Astronomy for Development

By TIBISAY SANKATSING NAVA & RAMASAMY VENUGOPAL

A lot has happened since work at the [IAU Office of Astronomy for Development \(OAD\)](#) first began in March 2011, and the IAU General Assembly presents a wonderful opportunity to share our highlights with the astronomy community. But before we get down to the details, it is worthwhile giving a brief overview of what the OAD is about.

Astronomy combines science and technology with inspiration and excitement. In this capacity it can play a role in facilitating education and human capital development, as is described in the [IAU Strategic Plan](#). The skills related to the field of astronomy can also be used to further sustainable development throughout the world. As a central part of the Strategic Plan, the OAD aims to mobilize the human and financial resources necessary in order to realize the field's scientific, technological, and cultural benefits to society.

The OAD is tasked with initiating, supporting, and funding programs in three core areas: universities and research, children and schools, and public outreach. In the past three years, 68 projects have been funded by the OAD and implemented around the world. The [call for proposals](#) for this year's funding is open to



submissions until 15 September.

A single international office cannot sufficiently understand the local needs in all regions of the world. It is therefore extremely important for the OAD to have regional support from representatives who understand the local situation. With this in mind, the OAD established and coordinates Regional Offices (ROADs) and Language Expertise Centers (LOADs) across the world. ROADs are established within host institutions and employ a full time coordinator with a focus on activities in a specific geographic region. LOADs have a similar structure, but with a focus on a particular language or cultural region. As of July 2015, eight ROADs (East Asia, South East Asia, East Africa, Southern Africa, West

Focus Meeting 20: Astronomy for Development

Start date	Thursday, 13 August
End date	Friday, 14 August
Oral sessions	Room 316B, Hawai'i Convention Center
Posters	Exhibit Hall 1, Hawai'i Convention Center
Coordinating Divisions	Division C: Education, Outreach and Heritage

For details on presenters, topics, and times see the [online program](#) or [mobile app](#).

Africa, the Andean Region, the South-West Asian, and Arab), and three LOADs (Chinese, Portuguese, and Arabic) have been established.

The OAD has recently launched the OAD Mentorship Program to help connect mentors and mentees, either in the same country or across the world. Mentors and mentees will be able to sign up [online](#) and specify their expectations and availability. The program will also provide participants with training materials and mentoring tools.

Today and tomorrow at the IAU General Assembly, the OAD will host [Focus Meeting 20, Astronomy for Development](#), which will focus on the global developmental impact that all aspects related to astronomy can deliver. An important part of FM 20 is the “unconference” session. We are still collecting potential topics for this session at the OAD booth (329) in the Exhibit Hall — please stop by and contribute your ideas.

The map in our booth shows the locations of all of the OAD-funded projects and ROADS, as well as the national contacts and astronomy club contacts collected by the [IAU Office for Astronomy Outreach](#). There's also a vision board where you can share your ideas for astronomy outreach and development (and see what others find important). 🌸



TIBISAY SANKATSING NAVA is a Visiting Fellow at the OAD. She is also Project Manager for the Netherlands of Universe Awareness.

RAMASAMY VENUGOPAL, a visiting fellow at the OAD, recently completed his master's degree in space studies at the International Space University in France.



Discounted Display Dome!

[Astro Haven Enterprises](#) announces an exceptional opportunity for astronomers in Hawai'i. The [12-foot observatory dome](#) on display at the IAU General Assembly is for sale at a special price — and it's already in Hawai'i, so you save on shipping too! To learn more, visit Booth 319 in the Exhibit Hall.



Lilly Bell or Herschel? Appin or Yamatanoorochi?

Vote for your favorite names for 20 exoplanets in the NameExoWorlds contest.

By IRIS NIJMAN, *Kai'aleleika*

Are you ready to make history? On Tuesday, 11 August, the IAU opened the online contest [NameExoWorlds](#): the first-ever opportunity for the public to decide the names of planetary systems.

The IAU is the authority responsible for assigning official names to celestial bodies. The first name it assigned was back in 1919, when our natural satellite was officially named “the Moon.” Hence it’s special that in 2014 the IAU listed 304 well-characterized exoplanets to be selected for public naming. These exoplanets belong to 260 exoplanetary systems comprising one to five planets each.

The 20 top ExoWorlds list is published on the website and includes 15 stars and 32 planets (five of the stars already have proper names). Astronomy clubs and other nonprofit organizations sent in proposals for the names of these objects. The names had to follow [IAU rules](#), for example, they had to be one word (if possible), pronounceable, and inoffensive.

During Tuesday evening’s ceremony, led by Sze-leung Cheung ([IAU International Outreach Coordinator](#)), Lisa Kaltenecker of Cornell University cast the first vote. Culminating the event, the audience was treated to a video message from Scott

Congratulations
to

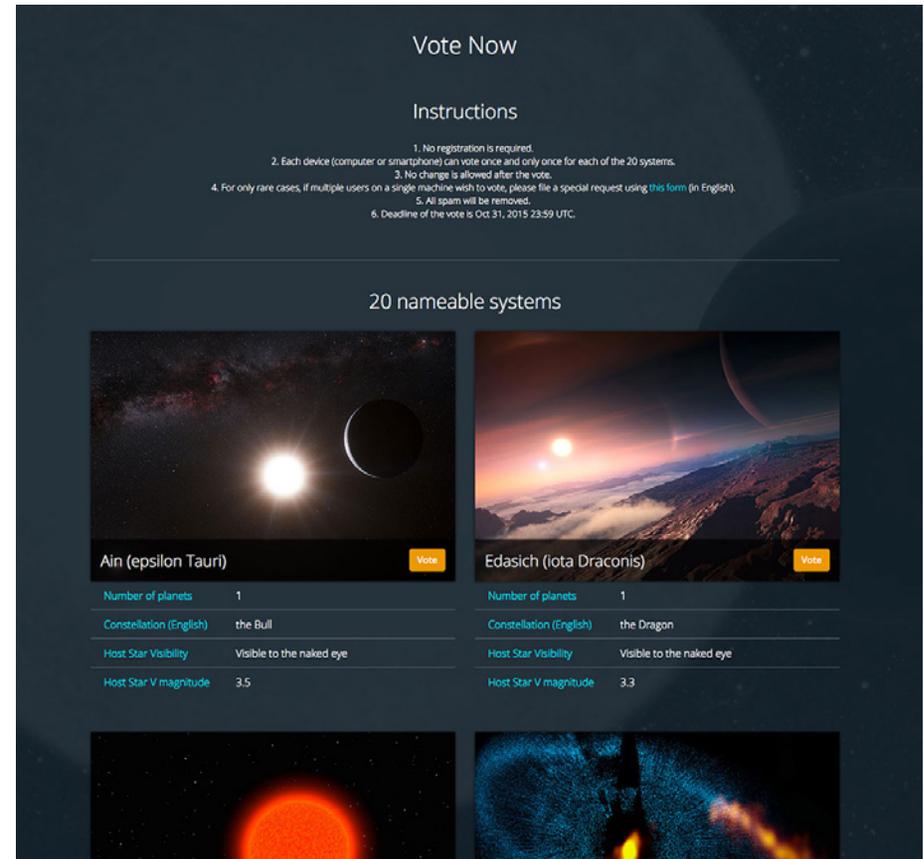
Jaan Lepson!



You have won a
\$25 gift certificate to
Tiki's Grill & Bar
at 2570 Kalākaua Ave.

Prizes can be redeemed, and raffles can
be entered, at Exhibit Hall Booth 336





Screenshot of the [NameExoWorlds voting page](#). [IAU]

Kelly, an astronaut aboard the International Space Station, wishing everybody a good conference to celebrate this special event.

Everybody can now vote on the NameExoWorlds website. There’s no need to register, as each device (computer, tablet, or smartphone) can vote only once for each of the 20 ExoWorlds. Complete [instructions](#) on how to vote can be viewed online. The closing date for entries is 23:59 UTC on 31 October 2015. 🌸

Career Advice from Generation to Generation

By RICK FIENBERG, *Kai'aleleika*

At lunchtime on Wednesday, about 200 early-career astronomers — most of them graduate students or postdocs — converged on Room 323 of the Hawai'i Convention Center. They filed past a long table stacked with several varieties of brown-bag lunch, made their choices, then sat down at round tables, each already occupied by one or two older astronomers eager to share their wisdom with the next generation. Welcome to the Young Astronomers Luncheon!

Introduced at the 2006 General Assembly in Prague, Czech Republic, this popular event offers a unique opportunity for those just getting started in the profession to network with more senior scientists from all over the world and with vast experience in academia and industry.



Co-organizer Ed Guinan welcomes attendees to the Young Astronomers Luncheon on Wednesday. [Rick Fienberg, *Kai'aleleika*]

While they dined on sandwiches, chips/crisps, cookies, and fruit, participants listened to three short presentations on programs targeted at new or soon-to-be Ph.D. holders. Oddbjørn Engvold of the Norwegian Academy of Science and Letters (NASL) described the International Schools for Young Astronomers and the newly established IAU Office for Young Astronomers. Kevin Marvel, Executive Officer of the American Astronomical Society, gave an overview of AAS programs for students and recent graduates. And Kevin Govender, Director of the IAU Office of Astronomy for Development, outlined OAD programs that can provide valuable experience and contacts for those just starting out in astronomy.

Co-organizer Ed Guinan (Villanova University, Pennsylvania)

Honolulu Almanac 🌐 13 August 2015

Sunrise / set	6:09 am / 7:03 pm
Twilight ¹ start / end	4:51 am / 8:21 pm
Moonset / rise	5:26 am / 6:32 pm
Moon phase ²	● New (<1% illum.)
Evening planet ³	Saturn (SSW)
Morning planet ³	Mars (E)
Special event	Perseid meteor shower (before dawn)

¹Astronomical twilight (Sun 18° below horizon). ²At meridian crossing ³Naked-eye planets. Source: timeanddate.com

then turned everyone loose to have informal conversations at their tables. He noted that in a pre-event survey, attendees indicated that they were mainly interested in talking about three topics: jobs, jobs, and jobs! Indeed, the conversations I joined or overheard as I circulated around the room were mostly about funding, grant-writing, and employment options — with some talk about work-life balance thrown in for good measure. The

DIVISION A

It's Fundamental

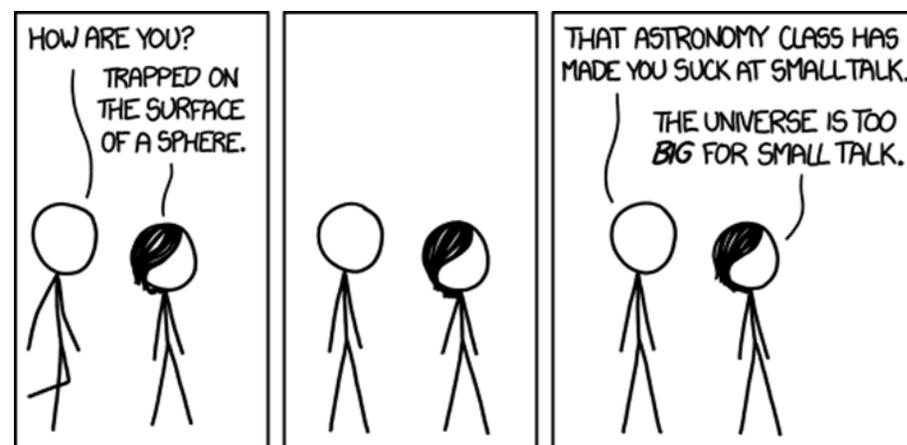
By ANNE LEMAÎTRE

On Thursday I anticipate assuming the presidency of [IAU Division A, Fundamental Astronomy](#). This division is tasked with the scientific and organizational development of fundamental astronomy and for ensuring that the most significant issues in the field are addressed with foresight, enterprising spirit, and scientific judgment. This new commission builds on the long legacy of former Division I, Fundamental Astronomy. As we move forward, we will foster new initiatives and international cooperation in fundamental astronomy, standardization of scientific results, and promoting investigations and discussions relating to the relevant topics and projects.

Looking ahead, our Division will need to address many challenges in the coming years. Within the new IAU organizational structure, we must establish efficient coordination of Division A Commissions, along with a means for constructive collaboration with other divisions. We must also participate meaningfully during the second phase of IAU's re-organization and define Working Groups that will advance our mission effectively. We must also work more effectively with the astronomical community by stimulating discussions and seeking feedback in all relevant areas, such as data, ephemerides, standard models, and fundamental constants. As part of this community dialogue, we will work to

younger participants seemed quite grateful to have a chance to discuss their ambitions and concerns with people who could not only empathize with them, but also offer concrete advice and suggestions drawn from their own careers.

This year's Young Astronomers Luncheon was sponsored by the NASL, the AAS, the OAD, the U.S. National Committee for the IAU, and the National Academies. 🌸



[xkcd]

encourage initiatives and to organize events, conferences, and meetings, including those that bring fundamental astronomy to the general public.

We also recognize the need to diversify our demographics. To promote early career scientists' participation in IAU meetings, we will seek young speakers for key roles and make sure our meetings and session topics reflect the needs of the next generation. As well as bringing in a younger cohort, we will also work on diversifying our Division by increasing the participation of women in committees, and as symposium invited speakers and organiz-

ers. Through all these efforts, we will work to establish new networks of researchers from different astronomical sub-disciplines and to increase interdisciplinary and diversity of collaborations.

Put simply, I want to see Division A contribute to the establishment of more efficient relationships between disciplines, between research teams all over the world, across diverse

groups, and between the general public and the professionals. 🌸



ANNE LEMAÎTRE is the incoming President of Division A and a Professor in the Department of Applied Mathematics of the University of Namur, Belgium, where she studies binary asteroids and planetary-system dynamics.

PUBLIC STAR PARTY

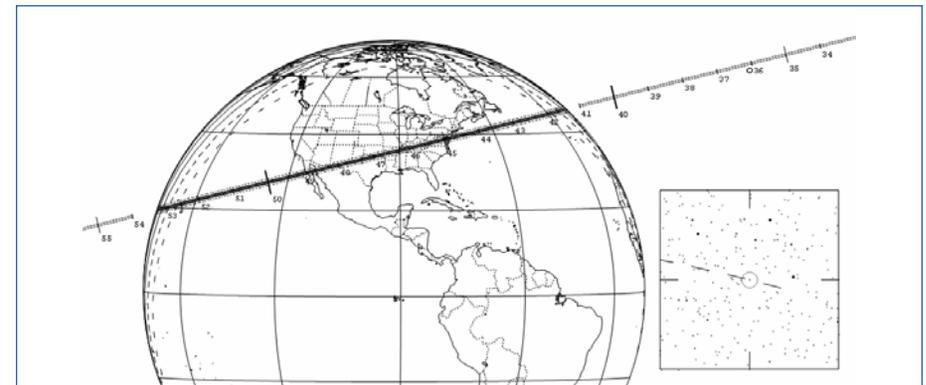
Asteroid Occultation at Ala Moana Beach Park

By DAVID W. DUNHAM

Asteroid (1197) Rhodessa, approximately 50 km (30 miles) in diameter, will occult a 9.6-magnitude star in Aquarius at 7:52 pm local time on Thursday evening, 13 August. Conveniently, this occurs during the IAU's public stargazing party planned for Ala Moana Beach Park. I'll be there with my occultation-timing equipment — weather permitting, of course.

The star, PPM 171360 = TYC 0527-01259-1, will disappear for up to 3 seconds. The nominal path passes just south of O'ahu, but with current pre-Gaia uncertainties, there's a roughly one-third chance that we'll see an occultation from Honolulu.

If Hilda doesn't spread too many clouds across our



On Thursday evening the shadow of asteroid Rhodessa is predicted to sweep across the continental United States from northeast to southwest and then cross the Pacific Ocean toward Hawai'i. Time is marked in minutes after 05:00 UTC (14 August) = 7:00 pm HAST (13 August). The 10th-magnitude star that will be occulted is charted at right. [asteroidoccultation.com]

eastern sky, you're welcome to join me in my attempt to record the occultation at the star party. You can find detailed predictions and charts for the event on Steve Preston's [asteroid-occultation website](http://asteroid-occultation-website.com). 🌸



DAVID DUNHAM is North American Coordinator for the *Journal of Occultation Astronomy* at the [International Occultation Timing Association \(IOTA\)](http://International Occultation Timing Association) and a major force behind professional-amateur collaboration in astronomy.

Keep in Touch!

Enhance and share your experience at the IAU General Assembly via social media! Use the hashtag #IAU2015 on Twitter, Facebook, and Instagram.

#IAU2015

Light Beyond the Bulb Visits Hawai‘i

By LINA CANAS

The glow of a candle, the rise of the Sun, and the illumination of a lamp are all things that can bring comfort and warmth to our lives. Light in all of its forms allows us to communicate, entertain, explore, and understand the universe we live in.

A new exhibition, Light: Beyond the Bulb, showcases the incredible variety of light-based science being researched

today across the electromagnetic spectrum, scientific disciplines, and technology platforms. The exhibit materials and striking images were crowd-sourced and expertly curated for scientific content, high-quality printability, and stunning beauty in order to engage the public.

The exhibition is part of the [Cosmic Light](#) cornerstone project for the [International Year of Light 2015 \(IYL 2015\)](#), coordinated by the [IAU’s Office for Astronomy Outreach \(OAO\)](#). It is organized by the same team that created the award-winning [From Earth to the Universe](#) project.

How to Say It in Hawaiian



- Hōkūlele: meteor, moving star
- Hōkūna‘i: asteroid, small star
- Hōkū puhipaka: comet (literally: tobacco-smoking star)
- Hōkūpa‘a: North Star (literally: immovable star)
- Makulu: Saturn
- Hōkū‘ulapīna‘au: Mars
- ‘Ilioki: Pluto

Vowels are generally pronounced as follows: a “ah,” e “eh,” i “ee,” o “oh,” u “oo.” If a vowel has a little horizontal line over it (a kahakō), it means you hold the sound an extra beat. A 6-shaped apostrophe, or ‘okina, signals a [glottal stop](#). Source: [Hawaiian Words](#).



Images from Light: Beyond the Bulb on display at the IAU General Assembly. [IAU/B. Tafreshi, [twanight.org](#)]

To date about [600 exhibitions](#) for Light: Beyond the Bulb have been registered across 30 countries. Locations include such diverse places as the National Mall, Washington, D.C.; the Galway Astronomy Festival, Ireland; the St. Ignatius College and Luqa Primary School, Malta; the Simón Bolívar Planetarium, Venezuela; Christchurch International Airport, New Zealand; and the Shanghai Nanhui Senior High School, China.

Do you want to host Light: Beyond the Bulb in your country? Drop by Booth 329 in the Exhibit Hall, and we’ll answer all your questions. Or head to the first floor of the Hawai‘i Convention Center and enjoy some of the images from the exhibition, if you haven’t already. 🌸



LINA CANAS is Assistant Outreach Coordinator in the IAU Office for Astronomy Outreach (OAO), based at the National Astronomical Observatory of Japan (NAOJ) in Tokyo.

Unconscious Bias

By FRANCESCA PRIMAS

The [IAU Executive Committee Working Group on Women in Astronomy](#) and the [AAS Committee on the Status of Women in Astronomy \(CSWA\)](#) have teamed up to present a series of three lunchtime “Scattered Talks” during the XXIX General Assembly.

The last of these talks, on the topic of unconscious bias, will be presented by Patricia Knezek of the National Science Foundation (NSF). Knezek has previously held positions at the National Optical Astronomy Observatory (NOAO), Space Telescope Science Institute (STScI), Johns Hopkins University, the Carnegie Institution of Washington, and the University of Michigan. She

served as the Chair of CSWA from 2003 to 2007. Her talk will take place today from 12:30 to 2:00 pm in Room 318A. Please bring your own lunch.

Everyone has unconscious biases. They reflect expectations or stereotypes that influence our judgments of others, which can positively or negatively impact the long-term career success of individuals, depending on which biases they are subject to. Being

aware of these unconscious biases is particularly important when making important decisions, such as during recruitment, selecting the speakers for a conference, and reviewing papers submitted for publication.

Each of our three presenters were asked to answer three questions. Knezek’s answers follow here.

Q1: What is the topic of your Scattered Talk?

PK: I will be talking about unconscious bias. I’ll cover what it is, how we know it exists, what its impact can be, and how to work to address it.

Q2: What are you most excited about at the IAU General Assembly?

PK: I’m excited to hear about all of the amazing science that is being accomplished! I’m also looking forward to seeing many friends.

Q3: What would be your key piece of career advice for women based on your own experience?

PK: I think the most important piece of advice I could give is to take a course on negotiating. I wish I had! And then, whether it is a new position or a promotion, don’t be afraid to ask for what is reasonable and what you deserve. 🌸



FRANCESCA PRIMAS is the Chair of the IAU Women in Astronomy Working Group. She is a Senior Astronomer at the European Southern Observatory, based in Garching, Germany.

Congratulations
to



Amir Levinson!



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*Prizes can be redeemed, and raffles can
be entered, at Exhibit Hall Booth 336*



Honolulu Weather Forecast 🌴 13-14 August 2015

THURSDAY, 13 AUGUST

High: 88°F / 31°C Low: 77°F / 25°C

Morning

Afternoon

Evening

Partly cloudy

Partly cloudy

Partly cloudy

20% chance of rain

5% chance of rain

5% chance of rain

FRIDAY, 14 AUGUST

High: 88°F / 31°C Low: 77°F / 25°C

Morning

Afternoon

Evening

Mostly to partly cloudy

Partly to mostly cloudy

Mostly to partly cloudy

25% chance of rain

25% chance of rain

20% chance of rain

Extended forecast: Moderate trade winds are expected as tropical storm Hilda slowly advances toward Hawai'i Island during the next two or three days. Hilda is expected to bring widespread rain across Hawai'i Island, and some rain may eventually spread to the smaller islands. Sources: [Weather Underground](#), [National Weather Service](#).

Ocean Lover Serving Food

When you spend a week or two at a conference, you eventually come to regard some of the people who staff the venue — security guards, concession-stand vendors, and the like — as acquaintances and perhaps even friends. Today I'd like to introduce you to **Rudy Salcedo**, a catering services manager who was born and raised in Honolulu. I spoke to him yesterday, which he informed me was his 42nd birthday.

Happy birthday! Any plans for today?

I have to work the whole day, including the networking reception tonight. But I might go for some drinks afterwards.

What do you like about this work?

I like meeting new people and making them happy. If they're happy, I'm happy! But I have done a lot of different things in my life, including being a nuclear submarine painter at the Department of Defense at Pearl Harbor. But I like the job I have now — I'm an expert at serving guests.

What's the best food we can get around here?

At the concession stand we have hot bowls with local island-made food every day. The people on this island have a lot of different ethnic backgrounds, so the food is mixed oriental, like chicken battered in sweet mochiko. My favorite restaurants are [Sam Choy's](#) and [Hy's Steak House](#) in Waikiki.

What do you like most about Hawai'i?

The Ocean! I like surfing with my GoPro camera. A good spot is Kaneohe, where you can see Honus (green sea turtles).

— *Iris Nijman, Kai'aleleika*



Rudy Salcedo poses with the traditional Hawaiian shaka (or “hang loose”) hand gesture. *[Iris Nijman]*

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Image credits: NASA, NSF, AFRL

Studying Gender in Talks at the IAU General Assembly

By JAMES R. A. DAVENPORT

If you've been watching closely at the Honolulu General Assembly, you may have noticed that audience members are not just paying attention to *what* is being asked during question-and-answer (Q&A) periods, but also to *who* is doing the asking. Meeting participants are collecting data on the demographics of speakers and question-askers in as many talks as possible. Anyone can contribute to this effort using a simple [online form](#) that

Do men and women ask the same numbers of questions in talks?

works on laptops, tablets, and smartphones.

This project was inspired by a seemingly simple question that was posed to me: "Do men and women ask the same numbers of questions in talks?" Answering this query requires carefully studying astronomers in their native meeting habitat. I have been con-

ducting and coordinating data gathering for this study for two years now, and I need help from as many volunteers as I can get.

This year's IAU 2015 project is a continuation of studies done at past AAS and NAM meetings in the U.S. and U.K., which analyzed how frequently men and women asked questions in a wide range of conference talks. The original study from the 223rd AAS meeting ([Davenport et al. 2014](#)) found that women

were underrepresented among question-askers in talks and that the gender of the session chair influenced the ratio. A follow-up study ([Pritchard et al. 2014](#)) of NAM 2014 found that when Q&A sessions reached at least four questions, the gender ratio approached unity.

The goals of this ongoing study are to understand the behaviors of meeting participants and to develop "best practice" suggestions for promoting an inclusive and accessible meeting environment. The IAU XXIX General Assembly provides a unique opportunity to study how a large international group of scientists interact.

So far we've seen a great volunteer turnout, with surveys received from nearly every talk. Please consider helping us during the final days of the General Assembly by reporting your own observations using our [webform](#). 🌸



JAMES R. A. DAVENPORT is a recent graduate of the University of Washington in Seattle and an NSF Postdoctoral Fellow at Western Washington University in Bellingham. He is also the author of the data-analysis blog

[If We Assume](#).



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Katie Jameson!



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 at 2570 Kalākaua Ave.

Prizes can be redeemed, and raffles can be entered, at Exhibit Hall Booth 336



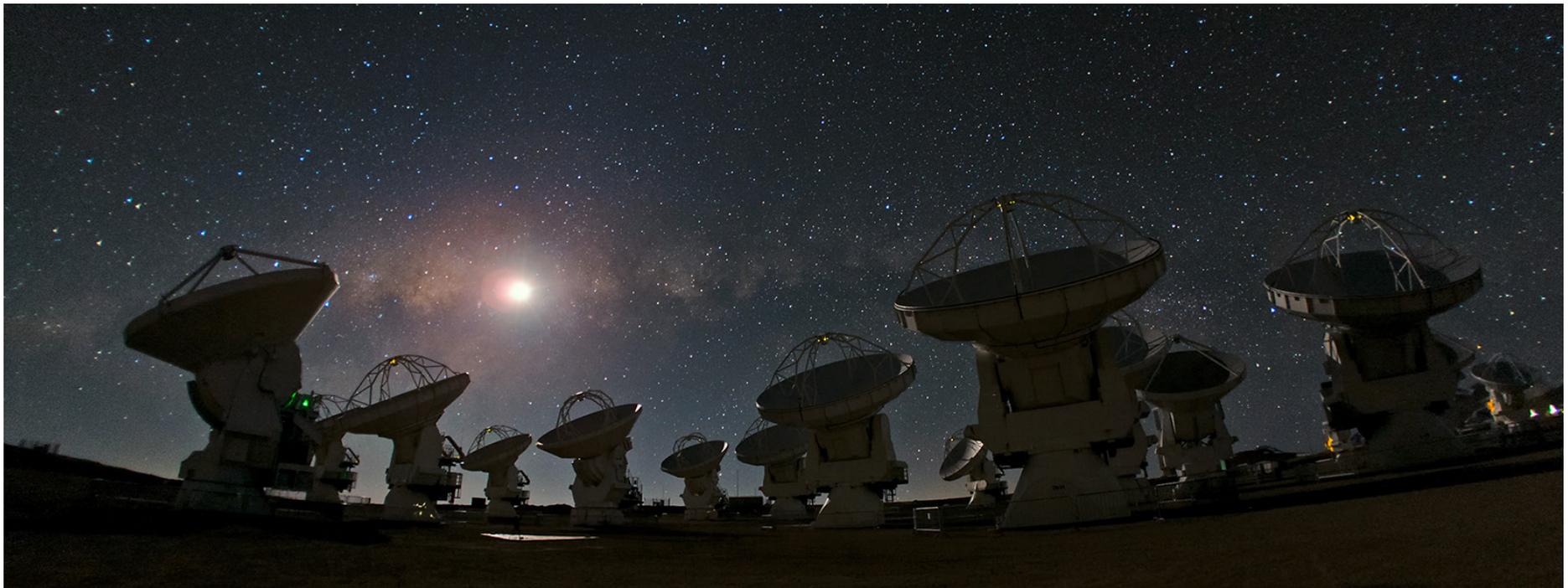
Coordination of Ground & Space Astrophysics & Heliophysics

By DAVID SPERGEL

From the transit expeditions of 1761 to JWST, ALMA, and SKA, international projects have played an important role in driving astronomy and heliophysics. Over the past two decades, the increasing complexity and cost of new facilities, the constrained amount of funding available from individual sources, and the rapidly increasing volume of data produced by newer facilities have made international collaboration on large ground- and space-based facilities essential to moving the fields forward. As international cooperation becomes commonplace, data-sharing policies have become ever more important. All IAU members have a

stake in the policy decisions made by nations and various scientific consortiums concerning data access and international collaborations. This focus meeting provided a forum to discuss how to improve coordination of global strategic planning in astronomy, astrophysics, and heliophysics in order to maximize the scientific return from research facilities.

There are many open questions driving our work: How do we coordinate these international planning efforts? How do we balance national prioritizations with the increasing multi-national structures of our projects? How can and should we share the



The ALMA telescopes at night. [ESO, B. Tafreshi]

data produced both by these international collaborations and by other projects? How should we provide access to these facilities? Furthermore, the huge volume of data produced by current and future observation systems necessitates modes of research that have not heretofore figured prominently in astronomical and heliophysical research enterprises. The Daniel K. Inouye Solar Telescope (DKIST) will collect 3.65 petabytes in its first year of science operations, while the Large Synoptic Survey Telescope (LSST) will produce 30 terabytes of data per night, equaling DKIST's output roughly every 4 months.

The potential benefit of enhanced international coordination is high. Much can be learned in astrophysics by adopting a broad-scoped approach in which ground- and space-based facilities look at the same target with different wavelengths, time-scales, and technologies. Such an approach requires more resources than a single nation could maintain. Heliophysics has the added

issue of coordinating truly global ground-based systems and space missions in various regions of the Sun-Earth system. In this context, Earth is an additional spacecraft embedded in its own space plasma environment. For the first time in history, we are capable of looking at a complicated, coupled, space system in its entirety. Today we can explore from the Sun through the heliosphere, magnetosphere, ionosphere, and atmosphere down to the biosphere in which we try to survive climate change. To study and understand the system around us is the ultimate benchmark to be able to understand other star-planet systems. 🌸



DAVID SPERGEL is Chair of the Princeton University Dept. of Astrophysical Sciences and Chair of the Space Studies Board of the U.S. National Academy of Sciences. He also chaired the Organizing Committee for last week's Focus Meeting 11 on coordinating ground- and space-based studies.

COMMISSION B5

A New Home for Laboratory Astrophysics

By FARID SALAMA

We are witnessing a rapid growth in quantity and quality of astronomical measurements, both from ground- and space-based facilities. This advance is driven by a combination of new and larger telescopes equipped with more sensitive detectors, and with capabilities to acquire high spectral- and spatial-resolution data over a broad range of wavelengths. Interpreting these superb observations requires an understanding of the fundamental properties and processes of atoms and particles, molecules, ions, and solids to an unprecedented precision. This need has attracted the attention and the interest of laboratory and theoretical scientists from different disciplines who, for years, have brought new or improved laboratory techniques, and large-scale theoretical calculations or simulations to astronomy and planetary science.

The goal of the newly formed [Laboratory Astrophysics Commission, B5](#), is to advance our understanding of the universe through the promotion of fundamental theoretical and experimental research into the underlying processes that drive the cosmos.

To achieve this goal, the Commission will facilitate interactions between the international community of astronomical, planetary and solar physicists, and the experimentalists and theorists who provide this community with necessary physical and chemical data. C.B5 naturally evolves from the previous Commission 14, Atomic & Molecular Data, and will naturally draw and expand on its experience in serving the broader astronomical community in the coming years. In addition, the C.B5 will adopt a strategy

to promote, in liaison with relevant international parties, the field of laboratory astrophysics, particularly with reference to ground-based and space-born astronomy and planetary science missions. The Commission also plans to work closely with other Commissions drawn from Divisions across the IAU.

C.B5 will encompass the four fundamental research areas that generate astrophysical data needs: atomic and molecular astrophysics, physics and chemistry of solid materials and condensed matter (dust and ices), plasma astrophysics, and nuclear and particle astrophysics. The Commission will embrace interdisciplinary studies crossing physical, chemical, biological, and geological sciences of relevance to astronomy — including experiment, theory, and modeling, from the nuclear and atomic/molecular level to application on astronomical scales.

The new Commission is designed to address the future multi-disciplinary needs and requirements of modern astronomy and planetary science and will solicit observer seats on the OCs of those bodies where strong crossover exists. Reciprocally, to increase cross-fertilization, the Commission will offer observer seats to interested parties from other commissions and divisions of the IAU, to discuss special needs in their particular domains and co-develop joint working groups and/or joint IAU symposia to address such needs. We hope that this IAU GA will be an opportunity to explore and initiate these crossover interac-

tions. The Commission also plans to create working groups along themes that are mission-driven, data-driven, and development-driven, or based on emergent new scientific directions.

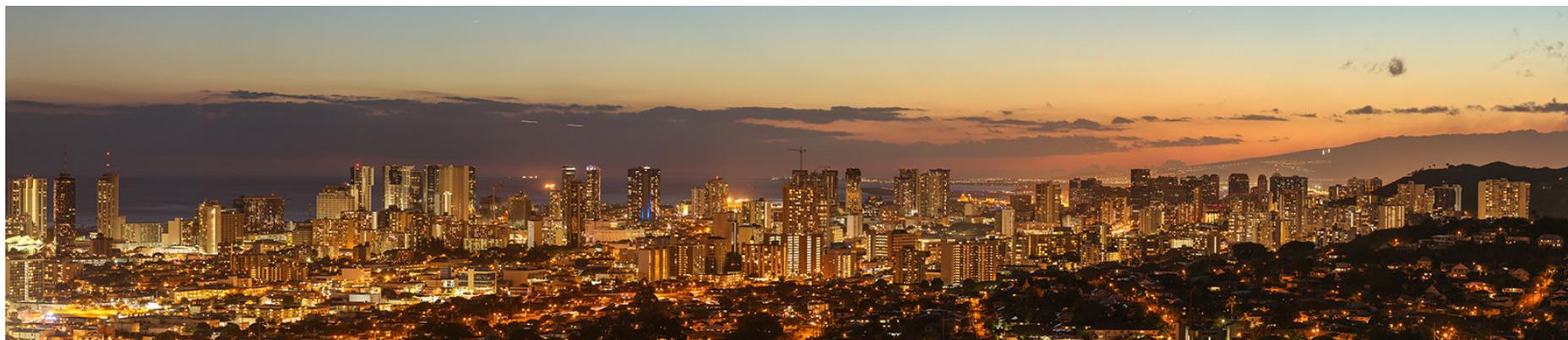
In summary, the Laboratory Astrophysics Commission is a cross-disciplinary commission aiming to promote laboratory astrophysics and assist all IAU members by providing the data needed to interpret and understand astronomical observations. 🌸



Debra Elmegreen, then President of the AAS, formally recognized the AAS Laboratory Astrophysics Division upon its creation in June 2012. [Bill Andrews]



FARID SALAMA of NASA's Ames Research Center in Moffett Field, California, is founding President of the new IAU Commission B5 and the incoming Chair of the Laboratory Astrophysics Division of the AAS.



[IAU/B. Tafreshi, twanight.org]

Massive Stars

By ARTEMIO HERRERO DAVO

I would like to present the new IAU Commission G2, Massive Stars, which is the direct successor of the [IAU Massive Stars Working Group](#) that has been active since 1995. I extend my gratitude to everyone who contributed during all these years to the success of the Working Group.

New developments in the field of massive stars will require strong research efforts for at least a decade, and new avenues into the future will be opened by new telescopes and instruments that will become a reality at the end of that decade. Massive stars will remain one of the main research foci of the astronomical community for at least the next two decades. This IAU Commission will promote the development of the field and provide a well-defined forum for discussion and results dissemination. As stated in the proposal submitted to the IAU, the Massive Stars Commission for the next years will concentrate on the following tasks:

1. Maintain the [Massive Stars Newsletter](#), the 24-hour announcement service that distributes new massive-star submissions to subscribers within 24 hours, and promote dissemination of these services.
2. Continue promoting international conferences and workshops. The next IAU Symposium on massive stars, IAUS 329, The Lives and Death-throes of Massive Stars, will be held in Auckland, New Zealand. Proposed dates are 28 November to 2 December 2016.
3. Increase our efforts to strengthen links with other research communities and make our results easily accessible to them. Toward this aim, we will promote the Massive Stars Newsletter among those communities and look for common meetings and develop web tools for massive-star research.



The Local Group irregular dwarf galaxy IC 1613 as seen by the William Herschel Telescope, the Galaxy Evolution Explorer, and the Very Large Array. Young star-forming regions with large numbers of low-metallicity massive stars are easily identifiable, particularly in the large bubbles in the northeastern region. [G. Perez (SMM-IAC) & M. Garcia (CAB)]

4. Foster new ways of active participation in our community, particularly for young researchers, through regular consultation and web tools. We expect a large number of Associates for which these ways of participation will be of primary importance.
5. Reinforce public outreach by means of open web pages, public talks, and seminars. To achieve this we will seek links with and advice from the IAU Office for Astronomy Outreach and the National Outreach Contacts.

Massive-star research is centered on the stars themselves, but it offers a large number of links to other areas of astrophysics. Massive stars are very luminous, and thus they can be studied

individually at relatively large distances via high-resolution spectroscopy, spectropolarimetry, or interferometry. They are the key agents behind starbursts and giant HII regions. Due to these broad topics, we feel that the new Commission will be of interest to a large community, and we invite all interested astronomers to join us. 🌸



ARTEMIO HERRERO DAVO was born in Valencia, Spain, and obtained his Ph.D. at Ludwig Maximilian University in Munich, Germany. He is Professor of Astrophysics at the Institute of Astrophysics of the Canary Islands and La Laguna University in Tenerife, Spain. He is incoming President of IAU Commission G2, Massive Stars.

COMMISSION H4

Stellar Clusters Throughout Cosmic Space and Time

By RICHARD DE GRIJS

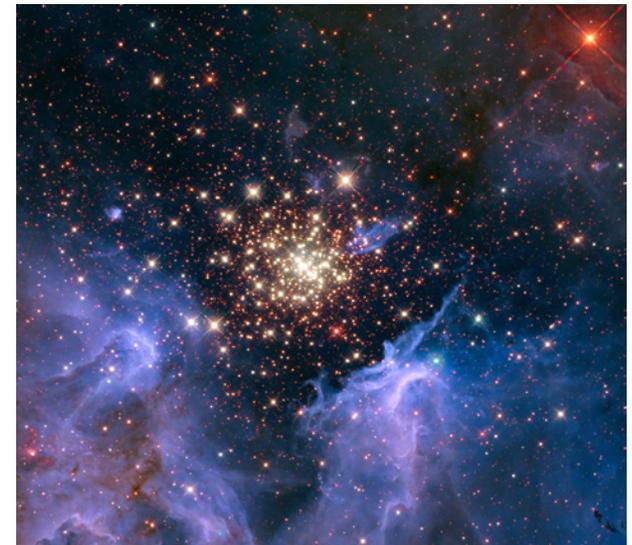
[Commission H4, Stellar Clusters Throughout Cosmic Space and Time](#), is a new Commission for scientists unraveling the mysteries of stars and stellar evolution using star clusters. Star formation results from the fragmentation of molecular clouds into star clusters.

Over time, open clusters dissolve or are destroyed by interactions with molecular clouds or through tidal stripping, and their stars become part of the general field population. Star clusters are thus among the basic building blocks of galaxies. In turn, star-cluster populations, from young associations and open clusters to old globular clusters, are powerful tracers of the formation, assembly, and evolutionary history of their parent galaxies. Star clusters are the observational foundation for stellar astrophysics; they provide essential tracers of galactic structure, and they represent unique stellar dynamical environment.

Our understanding of star formation, stellar structure, stellar evolution (including the importance of binary systems and stellar rotation), and stellar nucleosynthesis continues to benefit and improve tremendously from the study of star clusters. Additionally, fundamental quantities, such as the shape of the stellar initial mass function and its postulated environmental dependence, can be successfully derived from modeling either the Hertzsprung–Russell diagrams or the integrated velocity structures of, respectively, resolved and unresolved clusters.

Star-cluster studies thus span the fields of galactic and extragalactic astrophysics, while heavily affecting our detailed understanding of the process of star formation in dense environments.

Recent advances in instrumentation are driving a renaissance in studies of galactic clusters, while extragalactic cluster studies are significantly aided by the development of new instrumentation supporting ever-wider fields of view. Dynamical modeling of both individual clusters and entire cluster systems, at any age, poses a considerable challenge for both theory and computa-



The Starburst Cluster displays celestial fireworks. [NASA, ESA, R. O’Connell (Univ. of Virginia), F. Paresce (INAF), E. Young (USRA, NASA/ARC), the WFC3 Science Oversight Committee, and the Hubble Heritage Team (STScI, AURA)]

tional requirements. The six-dimensional coverage of phase-space by Global Astrometric Interferometer for Astrophysics (Gaia) will soon have a major impact. From the Chandra/XMM telescopes and the Galaxy Evolution Explorer (GALEX) at short wavelengths to the Spitzer Space Telescope and Herschel in the mid- and far-infrared and the Atacama Large Millimeter/sub-millimeter Array (ALMA) at millimeter wavelengths, our observational window for studying both star clusters and their stellar populations is unsurpassed in terms of wavelength coverage and spatial resolution. With major efforts being expended on the planning for new 30–40 meter telescopes, now is the time to look forward to future progress in mapping a representative slice of the local Universe at the highest possible resolution and thus in the greatest detail ever achieved. Combining the emerging, unprecedented understanding of local stellar populations with observations of galaxies (“composite” stellar populations) at ever-higher redshifts, we now have a fighting chance

to constrain the evolution of the basic galactic building blocks throughout space and time.

Our predecessor Commission 37 filled a real need in the community. Commission H4’s Organizing Committee aims at re-establishing an active Commission. We call on the IAU membership at large to support our efforts in trying to understand the large variety of physical aspects that studies of star clusters and their stellar populations can contribute to. We are looking forward to welcoming your contributions and encourage anyone to join Commission H4’s membership. ✿



RICHARD DE GRIJS is Professor of Astrophysics at the Kavli Institute for Astronomy and Astrophysics at Peking University, China, and Discipline Scientist at the International Space Science Institute–Beijing, China. He has been leading the IAU’s East Asian Regional Office of Astronomy for Development since its inception in 2012. [Portrait: Zhang Wenxin]

COMMISSION X1

Supermassive Black Holes, Feedback & Galaxy Evolution

By WILLIAM FORMAN & THAISA STORCHI-BERGMANN

[IAU Commission X1](#) is a new cross-division commission that combines scientific interests from Division D, High Energy Phenomena and Fundamental Physics, and Division J, Galaxies and Cosmology, to explore feedback processes over cosmological time between supermassive black holes (SMBH), their host galaxies, and the surrounding environment. The discovery of the correlation between galaxy properties and SMBH mass, the understanding of the key role of feedback in galaxy evolution models to regulate galaxy growth, and the detection of radio-mode feedback in all hot gas-rich systems have demonstrated the key role of feedback.

Feedback studies utilize the broadest wavelength range

including gamma-ray and X-ray satellites, the Hubble Space Telescope, integral-field spectrographs on 8- to 10-meter-class telescopes, and all manner of radio observations. Major observatories are dedicating significant fractions of their time to observe and characterize these phenomena and constrain the relevant physical mechanisms.

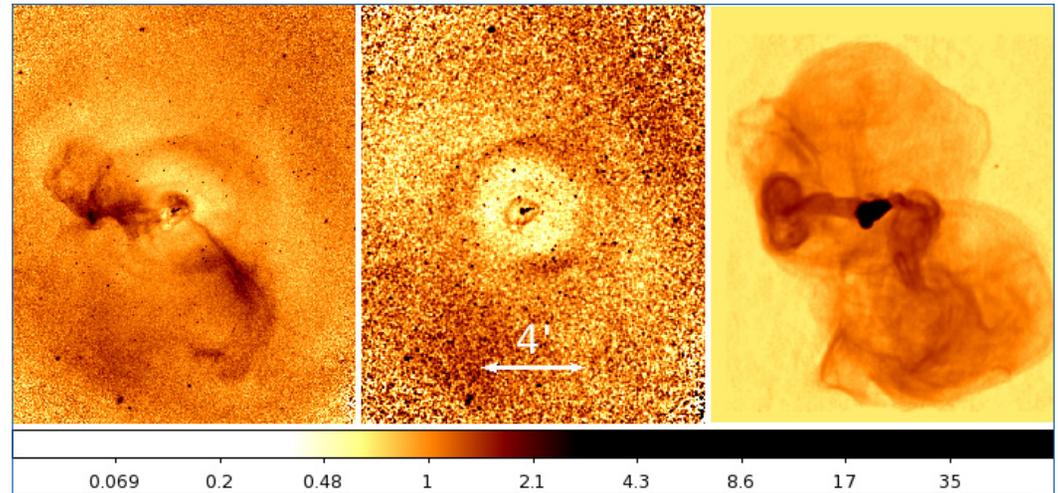
Commission X1 will facilitate communication among interested researchers to coordinate multiwavelength observations and theoretical efforts that are key to advancing the field. We thus plan to bring together observers, from across the electromagnetic spectrum, with theorists to understand the interplay between the growth of supermassive black holes and

galaxy evolution, from the earliest epochs to the present day universe.

The Commission plans to continue the past progress and extend the discussion to directly address active galactic nuclei and galaxy interactions at high redshifts. Detailed studies at high redshift will be possible with future, more powerful observatories, both on the ground (notably the Large Synoptic Survey Telescope, European Extremely Large Telescope, Giant Magellan Telescope, and Thirty-Meter Telescope in the optical and infrared; and the Jansky Very Large Array, Square Kilometre Array, Giant Meterwave Radio Telescope, and Low-Frequency Array in the radio); as well as in space (James Webb Space Telescope, Euclid, Wide-Field Infrared Survey Telescope, Athena X-ray Observatory, Advanced Technology Large Aperture Space Telescope, and X-ray Surveyor).

The goals of IAU Commission X1 are to promote the development of the field and foster interaction between observational and theoretical astronomers working on all covered topics, providing a well-defined forum for discussion and dissemination of results. To achieve this goal, we plan the development and support of the following activities, most of which will begin in the first year of the Commission and continue through its duration:

- Provide a forum for discussions about the best observational campaigns.
- Enable a forum for discussion of particular objects or classes of objects to be observed along with needed multiwavelength surveys.
- Support, propose, and organize meetings, especially IAU Symposia.
- Encourage discussion of theory and simulations and support the dissemination of computing codes. Our Organizing Committee includes theorists who are expert in simulation.
- Plan and coordinate sessions at IAU General Assemblies.



These images of M87 in Virgo are matched to scale and show the galaxy in soft X-rays (left, from Chandra), hard X-rays (middle, also from Chandra), and radio wavelengths (from the VLA). Most of the structure visible in the images can be traced to energetic activity in the central supermassive black hole. [William Forman]

- Prepare a quarterly newsletter to announce meeting deadlines, key science advances, opportunities for collaboration, and observing proposal deadlines.

The Commission organizers (Bill Forman, Harvard-Smithsonian Center for Astrophysics, and Thaisa Storchi-Bergmann, Rio Grande do Sul Federal University) welcome suggestions and participation in Commission activities from all interested scientists. We look forward to working with all interested members of the IAU and the astronomical community. ❁



BILL FORMAN has spent his career concentrating in the field of X-ray astronomy using satellite observations from Uhuru, Einstein, Rosat, and Chandra. He is Associate Director at the Harvard-Smithsonian Center for Astrophysics for the High Energy Astrophysics Division. **THAISA STORCHI-BERGMANN** is a professor at the Rio Grande do Sul Federal University, Porto Alegre, Brazil, where she is Head of the Astrophysics Research Group. She won the 2015 L'Oreal/UNESCO Prize for Women in Science.

Fundamental Standards

By CATHERINE HOHENKERK

[Commission A3, Fundamental Standards \(FS\)](#), is a new Commission in Division A, Fundamental Astronomy ([see page 11](#)). At the last General Assembly, the IAU announced its goal to reorganize the Commissions to make them more relevant to the members. With that in mind, it seems to me, nothing is more relevant than the issue of standards. I refer not only to the standards used to produce the products and services we use as astronomers (and consumers in general), but more importantly, to the standards that are used by us in the products, services, and research we carry on as scientists.

Users of IAU fundamental standards include governments, businesses, scientists, engineers, and astronomers; some are members of the IAU, and some are not. When told that something is an IAU standard, what does that actually mean? How does it apply to me and the particular product or service that I am interested in or produce? Where should I go to find out about standards? If I am not an expert in the field, will I be able to find an understandable explanation of the standards and its application? Once an IAU Resolution is adopted, how is it implemented in practice?

Upon investigating, I found that two Past Presidents of Division I (the predecessor of Division A), Dennis McCarthy (USNO, retired) and Nicole Capitaine (Paris Observatory), had similar ideas. Thus together with Brian Luzum (USNO & the International Earth Rotation and Reference Systems Service), we put forward a successful proposal for this new Commission. Brian Luzum has now been elected Vice-President, and the Organizing Committee will benefit from elected members John Bangert (USNO, retired) and Charles Acton (JPL).

The goal of FS is simple: to facilitate advances in astronomy

and other fields of science and engineering by developing, implementing, and communicating IAU-endorsed standards for fundamental astronomy. Such standards include, but are not limited to, celestial and terrestrial reference systems and frames, time-scales, precession-nutation and Earth orientation models, star catalogs, and solar-system ephemerides. Details may be found at our [temporary website](#).

An important role will be cooperation and collaboration with various groups within the IAU to provide not only state-of-the-art services, but also to develop standards and services designed to meet emerging needs. Such Division A groups include Standards of Fundamental Astronomy (SOFA), the Working Group (WG) on Numerical Standards of Fundamental Astronomy (WGNSFA), and the Division F/A WG on Cartographic Coordinates & Rotational Elements (WGCCRE). Other IAU groups, such as producers of solar system ephemerides, and external groups such as the International Association of Geodesy (IAG) and the Global Geodetic Observing System's Bureau of Products and Standards, have also been very supportive and will provide valuable expertise. SOFA, the WGNSFA, and the WGCCRE (all long-term Working Groups) already play an important role in developing and promulgating IAU standards via software and numerical data.

FS will serve as the primary point of contact between Division A and the broad user community regarding IAU standards for fundamental astronomy. 🌸



CATHERINE HOHENKERK is the President of Commission A3: Fundamental Standards. She is a Senior Analyst at H.M. Nautical Almanac Office, which is part of the U.K. Hydrographic Office in Taunton, U.K.