

# CHAPTER I

## TWENTY NINTH GENERAL ASSEMBLY

### INAUGURAL CEREMONY

Monday, 3 August 2015, 16:00-18:00

Hawai'i Convention Center, Honolulu, HI

#### 1. Opening Event

The XXIXth General Assembly was opened by a Oli Chant and Blessing by D. Akaka Jr.

#### 2. Opening Address

*Prof. Norio Kaiifu, IAU President*

Respective guests, ladies and gentlemen, and all friends, good evening, and Aloha! Welcome to the 29th IAU General Assembly here in Honolulu! And thanks for all hospitalities of Hawai'ian community. Hawai'i had been the place where the IAU General Assembly must visit, and now we are here. Hawai'i is well-known as a cultural, economic and tourism center in the Pacific region, but for we astronomers Hawai'i had been particularly important, because it is one of the most active frontiers of astronomical observations in the world for more than half a century.

This 29th General Assembly in Honolulu has some special features through the history of IAU.

Firstly, the total reconstruction of scientific organizational structure of IAU will be completed in this GA, by finishing the reform of its Commissions. All new Commissions with new Steering Committees will start activities for the coming three years after Honolulu under a fresh and inclusive mandate. Through this reform the role of the nine Divisions becomes more central to IAU activity, and the Commissions will be more flexible in responding to the rapid evolution of astronomy in the 21th Century. I express deep thanks to Division and Commission Presidents and Officers who devotedly worked for this long-term process of reforming the IAU.

Secondly, the Honolulu GA was organized with six Symposia as usual, but also with 22 Focus Meetings and a variety of Division Meetings. This new meeting structure gives us more flexibility than before. Of course we need to observe the effects by these changes carefully, watch further activities under the new structure, and find better ways for the IAU. We understand, however, these changes are an inevitable evolution for the IAU, a rapidly-growing international union of scientists.

Thirdly, we will see in this GA the IAU firmly broadening its connection with other communities in the world, including education, promotion of scientific knowledge, and

contact with the general public. At this time, fifth years since the start of the IAU 10-years Strategic Plan “Astronomy for Developments”, Executive Committee received an extremely positive report from the OAD Review Panel, demonstrating fantastic success of the Astronomy for Developments project. I am happy to report that the Executive Committee held on Sunday in Honolulu adopted the new OAD Agreement between IAU and National Research Foundation of South Africa, to ensure further activity of OAD.

The OAO, Office for Astronomical Outreach was established in the NAOJ, Japan, just after the previous GA in Beijing. It has been working on the IYL2015, “International Year of Light 2015” cooperating with UNESCO. The OAO also actively developing cooperation with school teachers, students and children, amateur astronomers, and general public in the world particularly through the project “NameExoWorld”, which will announce during this GA the start of public voting for the names of selected Exoplanets.

Furthermore, the IAU signed the new agreement with the NASL, Norwegian Academy of Science and Letters, to open “OYA”, the Office for Young Astronomers, particularly for the promotion of International School of Young Astronomers. Together with OAD and OAO, the OYA will be IAU’s third Global office to support activities to develop astronomy and science in future. The IAU is now really one of the leading international scientific unions on education, outreach and developments in the field of basic sciences, and I am very much proud of it.

During this GA there will be many discussion about the future observing facilities which will provide exciting perspectives for astronomy. The TMT, Thirty Meter Telescope planned to construct on Maunakea.

However, with the increasing scope of astronomy we acknowledge that occasional conflict between our growing scientific activities and the interests of the general public may occur. In Hawai‘i, as you know, we hear voices that criticize the development of telescopes at Mauna Kea. The history of astronomy and its huge positive impact on civilization makes us confident that astronomical research will continue to open a vast new world for humankind, give us a better perspective to understand our world, and provide excitement and dreams to children. In parallel, we truly wish to respect all cultures, to remain entirely open in our activity, and to live with all nations and cultures together. As all astronomers in Hawai‘i know, and as I know from my many-years experiences here, Hawai‘i is a Land of Aloha. I expect you found my letter sent to all GA participants in the Registration Bag, together with some background information. Please note this letter and material, and if you have chance to contact people who wish to appeal or protest, we welcome you to talk these Hawai‘ian people respectfully and frankly.

As we anticipate, this 29th IAU General Assembly in Honolulu will be one of the largest, most active, and memorable General Assemblies in the history of IAU. I wish all of us have an exciting and fruitful time during the General Assembly.

And please enjoy Hawai‘i. Thank you for your kind attention.

### **3. Welcome address by the Governor of Hawai‘i**

*David Y. Ige, Governor of Hawai‘i*

Alhoa! On behalf of the people of the State of Hawai‘i, I send my warmest greetings to all members of the International Astronomical Union (IAU) attending the 2015 IAU General Assembly.

Since 1919 the IAU has been the international authority for assigning designations to celestial bodies and the surface features on them. representing the vast majority of

professional astronomers, its mission is to promote and safeguard the science of astronomy through international cooperation.

I am pleased that the IAU has chosen to hold this year's assembly in Hawai'i, where interest in astronomy is deeply entrenched in our island heritage. The heavens played a central role in ancient Hawai'ian culture, and early Polynesians relied on their knowledge of the stars to successfully navigate thousands of miles across the open ocean. Today, Hawai'i continues to be at the forefront of astronomical studies through the observatories at Maunakea on the island of Hawai'i and Haleakalā on Maui.

This triennial assembly promises to be an exciting and informative event, featuring more than 3,000 professional astronomers, and offering Symposia and Focus Meetings that cover a broad range of astronomical topics.

Mahalo [thank you] to the IAU, American Astronomical Society, University of Hawai'i at Mānoa Institute for Astronomy, and many event organizers for contributing to this worthy event. Please accept my best wishes for an enjoyable and successful meeting.

#### 4. Welcome address by the NSF Director

*France Cordova*

Let me thank President Kaifu, President Urry, and Director Hasinger for their invitation to deliver the inaugural address of this XXIX General Assembly of the International Astronomical Union.

It is a great honor to represent the Obama Administration at this historic event. As an astrophysicist myself, I am delighted to say aloha to my fellow IAU members and welcome all of you to this meeting.

I am also honored to represent the National Science Foundation the premier U.S. basic scientific research agency and one of the world's leading institutions in astronomy.

For more than six decades, NSF-funded researchers and facilities have been exploring the most intriguing mysteries of the heavens. Today, among those mysteries are the origin and evolution of stars and galaxies, the formation of solar systems, the existence of habitable planets, and the nature of dark matter and dark energy.

And what do we seek to discover from our observations of the heavens?

"To know the unknowable" this quote will be familiar to native Hawaiians.

In my own case, as a girl I had an early yearning to understand the mysteries of the universe. I didn't know what astrophysics was, but I had always loved looking at the night sky and asking, "Why are there stars? How are they formed? Why are there so many and no more? Why are some bright, while others are barely visible?"

Thinking about those questions resonated with me, as I am sure it does with you.

I started my career as an X-ray astronomer. Some years later, I was honored to become NASA's first female chief scientist.

And let me take this opportunity to congratulate our NASA colleagues for the spectacular success of their New Horizons Pluto Mission talk about new mysteries to solve!

As New Horizons has so vividly reminded us, people everywhere have a deep-seated yearning to understand the universe in which we live.

In October 2009, President Barack Obama invited a group of astronomers to the White House to mark the International Year of Astronomy, the 400th anniversary of Galileo's first use of a telescope to observe the night sky.

The President has long emphasized the study of science and astronomy in order to increase understanding of the natural world and to encourage greater scientific cooperation across national borders.

Nobel Prize-winning chemist Ei-ichi Negishi, in his 2010 speech accepting the award, said “The final reward for any researcher is to see his or her lifetime of work extend beyond academia and laboratories, into the mainstream of global society where it can breathe hope into the world.”

Isn't that the goal that all of us in the global research community strive to achieve? And let me add that the U.S. is proud to partner with many countries around the world in exploring the heavens. Basic research is the primary focus of the National Science Foundation, including astronomical breakthroughs that have changed our understanding of the universe.

One significant NSF-funded effort resulted last year in University of Hawai'i at Mānoa astronomer Brent Tully being awarded the 2014 Gruber Cosmology Prize and the 2014 Victor Ambartsumian International Prize.

Dr. Tully led an international team of astronomers in defining the contours of the supercluster of galaxies containing our own Milky Way.

Those astronomers named the supercluster “Laniakea”, meaning “immense heaven” in Hawaiian, to honor Polynesian navigators who used knowledge of the heavens to voyage across the immense Pacific Ocean.

The name was suggested by Nawa'a Napoleon, an associate professor of Hawaiian language at Kap'iolani Community College.

One new significant challenge for the National Science Foundation is the enormous increase in raw research data resulting from vastly increased computational capabilities also known as “Big Data.”

The growing field of machine learning in which computers learn from large data sets and find patterns that humans don't easily recognize has great long-term implications for astronomy. For example, the image at right is from “Solar Superstorms,” an ultrahigh-resolution demonstration that takes viewers into the magnetic fields and superhot plasma surrounding the Sun as it produces dramatic flares, violent solar tornadoes, and coronal mass ejections.

This groundbreaking scientific visualization is based on computations from the NSF-supported supercomputing initiative, Blue Waters, at the National Center for Supercomputing Applications at the University of Illinois.

As dramatic as the visualization is, it is only a hint of the advances Big Data may produce in years ahead.

While the National Science Foundation is widely recognized as our nation's premier basic scientific research agency, we find there are more international partnerships emerging that enable NSF to extend our ability to produce significant scientific research. We have found that global collaborations accelerate the progress of science and improve health, security, and prosperity throughout the world.

For example, the Atacama Large Millimeter/submillimeter Array or ALMA telescope has received more than \$1 billion in investments from a broad international coalition including Europe, East Asia led by Japan and Chile, with North American funding led by NSF.

ALMA is providing a testing ground for theories of star birth and stellar evolution, and solar system and galaxy formation.

A remarkable ALMA image of the young star HL Tau and its protoplanetary disk reveals multiple rings and gaps that herald the presence of emerging planets as they sweep their orbits clear of dust and gas.

Another significant NSF partnership involves the Gemini team of twin 8.1-meter optical/infrared telescopes on Cerro Pachón in Chile and on Maunakea here in Hawai'i.

The International Gemini Observatory is a partnership of the U.S., Canada, Australia, Brazil, Argentina, and Chile, as well as the University of Hawai'i as the host of the northern site. The Republic of Korea joined the partnership in 2015 as a limited-term collaborator and is expected to become a full partner in 2017.

Gemini's capabilities full-sky coverage, rapid response to transients, agile scheduling, and specialized optics enabled it to capture an image of the Kronberger 61 nebula, showing an ionized shell of expelled gas resembling a soccer ball. Incidentally, the nebula was named for an amateur astronomer in Austria.

The image was made by the Gemini Multi-Object Spectrograph GMOS on the Gemini North telescope on Maunakea.

Another cutting-edge, NSF-supported observatory is the Daniel K. Inouye Solar Telescope, now under construction on Haleakalā. This next-generation solar telescope represents a collaboration of 22 institutions, reflecting a broad segment of the solar-physics community.

Once completed, it will be the premier ground-based solar observatory. Thanks to the people of Hawai'i, it will enable astronomers everywhere to glean new insights into solar phenomena, including what are the mechanisms responsible for solar storms that ultimately affect the Earth.

Furthermore, we expect that this increased understanding of the Sun will help protect vital space-based assets such as communication and weather satellites and the power grids here on Earth.

The top recommendation of the 2010 National Academy of Sciences decadal survey of astronomy was the Large Synoptic Survey Telescope LSST which is now under construction on Cerro Pachón in Chile. Just a few months ago, I participated in the exciting "first stone ceremony" to launch LSST construction.

LSST will be a wide-field "survey" telescope that photographs the entire available sky every few nights. Advanced computers will gather and analyze the millions of gigabytes of data LSST will generate each year.

A pilot project called the Deep Lens Survey uses imaging from NSF's four-meter telescopes to suggest what half a degree of sky will look like when LSST is in operation, projected to begin in 2022.

An innovative citizen-science program will involve people of all ages in LSST discoveries, making discovery opportunities available to K-12 students as easily as to the professional astronomer. This is just one example of NSF's commitment to engaging the public in the thrill of discovery and increasing public understanding of scientific research.

Far from the 2,700-meter high Cerro Pachón in Chile lies NSF's IceCube Neutrino Observatory at the Amundsen-Scott South Pole Station in Antarctica.

IceCube is the world's largest neutrino detector and is among the most ambitious scientific construction projects ever attempted. It searches for neutrinos from the most violent astrophysical sources: exploding stars, gamma-ray bursts, and cataclysmic phenomena involving black holes and neutron stars.

The highest-energy neutrino ever observed by IceCube, with an estimated energy of 1.14 peta-electron-volts (PeV), was nicknamed "Ernie" by IceCube physicists.

I recently attended the inauguration of the High Altitude Water Cherenkov or HAWC gamma-ray observatory near Puebla, Mexico.

HAWC represents a unique partnership between the National Science Foundation, the U.S. Department of Energy, and CONACYT Mexico's National Council of Science and Technology. HAWC will give scientists a new window for detecting and recording gamma rays and cosmic rays emitted by black holes, merging neutron stars, streams of hot gas moving at close to the speed of light, and other exotic phenomena in the universe.

HAWC will monitor approximately two-thirds of the sky every 24 hours with unprecedented sensitivity to the highest-energy gamma rays. HAWC will complement the operations of NASA's Fermi Gamma-ray Space Telescope and the VERITAS gamma-ray observatory.

It will also be part of the growing field of "multi-messenger astrophysics" that includes cosmic ray observatories, IceCube, and the Advanced Laser Interferometer Gravitational-Wave Observatory.

Finally, I would like to say a few words about the beautiful setting that the IAU chose for its first General Assembly in the U.S. in nearly three decades.

No doubt the IAU was attracted by Hawai'i's breathtaking beauty, unique cultural heritage, and aloha spirit of its friendly people all great reasons for holding this assembly here. The National Science Foundation and many other scientific institutions worldwide come to partner in scientific research at an extraordinary site.

With its biodiversity on land and in the surrounding oceans, its unique geological history and formations, and its high volcanic peaks, Hawai'i is one of the Earth's great scientific treasures. It is a treasure that all of us want to see honored, preserved, and protected.

The National Science Foundation has partnered with the people of Hawai'i and Hawaiian institutions for many years and takes seriously its responsibilities to be a good steward of Hawai'i's unique natural resources and cultural heritage and to be respectful of Hawai'i's people and customs.

We hope to continue our partnerships in order to create opportunity for the next generations of seekers of knowledge for many years to come.

Let me again thank the International Astronomical Union for the opportunity to be with you for this historic General Assembly. Just as the universe knows no borders, the science community's exploration of its mysteries has always been an international endeavor. We look forward to the promise of even greater cooperation among nations and institutions as we expand scientific understanding of this endlessly fascinating challenge.

Again, I wish you all a productive meeting. Mahalo!

## 5. Presentation of Partners, Sponsors and Exhibitors

The IAU and Organising Committees acknowledge the invaluable support of the following institutions and organisations:

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## 6. The Gruber Foundation: Presentation of the Cosmology Prize 2015 and TGF Fellowship 2015

The President of the IAU, Norio Kaifu, opened the Ceremony, in the presence of

- Patricia Murphy Gruber, President Emeritus, The Gruber Foundation
- John Carlstrom, 2015 Cosmology Prize Recipient
- Jeremiah Ostriker, 2015 Cosmology Prize Recipient
- Lyman Page, 2015 Cosmology Prize Recipient
- Wendy Freedman, Chair, Cosmology Selection Advisory Board
- Norio Kaifu, President, IAU
- Thierry Montmerle, General Secretary, IAU
- Cristbal Petrovich, Cosmology Fellow

*Norio Kaifu:*

In year 2000 the Gruber Foundation created its International Prize Program with its inaugural prize in Cosmology. The intent of the Prizes is to call attention to the importance of accomplishments that benefit mankind in special, important areas of endeavor. The IAU is pleased to have been chosen by the Gruber Foundation to collaborate with them on the Cosmology Prize since its inception. The IAU has an advisory role in the constitution of the selection committee and as part of our collaboration we are very fortunate to receive an annual grant of \$50K from the Gruber Foundation to be awarded to a postdoctoral fellow.

It goes without saying that the prestige and reputation of any award is determined by the quality of its awardees. By this criterion the Gruber Cosmology Prize has done superbly. During the past decade the Cosmology Prize recipients alone could write as authoritative a history of the universe as any group. The careers of the Gruber Fellows have also benefitted greatly from the resources made available to them by the Gruber Foundation stipend.

In the years of the IAU General Assembly the tradition has been for the Gruber Cosmology Prize to be presented in this Inaugural Ceremony. It is my great pleasure to present to you the President of The Peter & Patricia Gruber Foundation and co-Founder & President Emeritus of The Gruber Foundation, which will continue the Gruber Prize



Program as part of Yale University, Patricia Gruber, who will introduce this year's Cosmology Prize awards ceremony.

*Patricia Gruber:*

Welcome to the presentation of the 16th annual Cosmology Prize, honoring a leading cosmologist, astronomer, astrophysicist or scientific philosopher for theoretical, analytical, or conceptual discoveries leading to fundamental advances in our understanding of the universe. On behalf of all of us at the Foundation, we are pleased to be here in Honolulu to present this Prize at the 29th General Assembly of the International Astronomical Union. Thank you, Norio Kaifu, for your warm welcome.

The Cosmology Prize was established in 2000 as the first Gruber international prize, and I'd like to acknowledge the founding vision and leadership of my husband Peter Gruber in establishing these prizes, as well as his passing. Peter died last fall after leading a long and productive life. Many know his story: he was born in Budapest and, after fleeing Hungary during WWII, his family settled in India where he was educated by Jesuits in the Himalayas. Later, he came to the US and went to work on Wall Street. His success as an asset manager allowed us to establish the Gruber Foundation and create the Prize Program a few years later. To further continue the legacy, an Agreement in 2011 with Yale University established the Foundation there, where the science prizes and human rights programs will continue to flourish.

The Cosmology Prize is presented in conjunction with the International Astronomical Union. It is my pleasure to introduce Thierry Montmerle, Secretary General of the IAU, who will say a few words about this fruitful collaboration.

*Thierry Montmerle:*

The primary goal of the IAU is the development of astronomy world-wide. To this end, the IAU is pleased to collaborate with the Gruber Foundation on the Cosmology Prize.

The collaboration between the Gruber Foundation and the IAU consists not only of the Cosmology Prize, but also an annual \$50,000 Fellowship. The fellowship is administered by the IAU and awarded competitively to a postdoctoral researcher—the stipend is to be used to further his or her research.

Awards are presented to promising young scientists of any nationality to pursue education and research at a center of excellence in their field; the IAU selects recipients from applications received from around the world. The fellowship has been awarded to scientists from Poland, India, Spain, Greece, the Russian Federation, Mexico, the UK, Colombia, and the United States.

The 2015 Gruber Fellow is Cristobal Petrovich, from Princeton University, from Chile. His work focuses on the dynamics of globular clusters, with the aim of providing a more realistic dynamical paradigm for this class of stellar systems. I am happy to introduce her on this occasion and invite her to say a few words.

*Cristobal Petrovich:* expresses thanks and makes brief remarks.

*Patricia Gruber:*

Thank you Cristobal Petrovich.

We are here to honor the achievements of John Carlstrom, Jeremiah Ostriker, and Lyman Page. But first let me tell you a little about the company they are keeping.

The Foundation's prize program, established in 2000, now presents three annual \$500,000 prizes in the fields of:

Cosmology; Genetics; and Neuroscience;

Each prize recognizes achievements and discoveries that produce fundamental shifts in human knowledge and culture. Until 2011, the Foundation also awarded prizes in Justice and Women's Rights. Under our succession plan with Yale University, these two prizes are now part of an exciting new program at Yale Law School.

The Genetics Prize will be presented at the annual meeting of the American Society of Human Genetics on October 9th, to Emmanuelle Charpentier and Jennifer Doudna.

On October 18th, at the annual meeting of the Society for Neuroscience, the Neuroscience Prize will be presented to Carla Shatz and Michael Greenberg.

Returning to Cosmology, the 2015 Prize recipients were selected by a distinguished Cosmology Prize advisory board:

- Wendy Freedman (Chair)
- Sadanori Okamura
- Rashid Sunyaev
- Frans Pretorius
- Helge Kragh
- Subir Sarkar
- Andrew Fabian

Owen Gingerich and Martin Rees also serve as special cosmology advisors to the Foundation. I deeply appreciate the knowledge, commitment, and enthusiasm that the advisors bring to the judging process. Let me now invite the advisory board Chair, Wendy Freedman, to present the official citation and introduce the scientific accomplishments of our Cosmology Prize recipients

*Wendy Freedman:*

The Recipients of the 2015 Prize are John Carlstrom, Jeremiah Ostriker, and Lyman Page.

The official citation reads:

The Gruber Foundation proudly presents the 2015 Cosmology Prize to Jeremiah P. Ostriker for wide-ranging theoretical work over 50 years, which has clarified our understanding of galactic structure and evolution, dark matter, the intergalactic medium and high energy astrophysics; and to John Carlstrom and Lyman Page for their leadership in ground-based observational CMB cosmology, including instrumentation: from TOCO and DASI to the South Pole Telescope and the Atacama Cosmology Telescope.

*John Carlstrom:* Expresses thanks, very brief remarks.

*Jeremiah Ostriker:* Expresses thanks, very brief remarks.

*Lyman Page:* Expresses thanks, very brief remarks.

*Patricia Gruber:*

Please note that the 2015 Gruber Cosmology Prize recipients will give public lectures entitled "What do we know about dark matter? An historical approach" and "The Cosmic Microwave Background: Where We Are and Where Are We Headed" at 12:45 pm

Wednesday, in this room. Thank you for attending the 2015 Cosmology Prize ceremony. This concludes our presentation.

## 7. IAU-NASL Office for Young Astronomers

*Oddbjørn Engvold:*

The International School for Young Astronomers is an essential and highly valued educational program of the IAU. Normally three weeks long, ISYAs are international postgraduate schools for regions where students have fewer opportunities to be directly exposed to up-to-date astrophysics. The schools are intended for young astronomers who are mainly — but not exclusively — from astronomically developing countries and who have already finished their first-degree studies. The main objective of ISYAs is to provide participants with exposure to modern astrophysics through lectures from an international faculty on selected topics of astronomy, seminars, practical exercises and observations, and exchange of experiences. Since the first ISYA in 1967, 36 have been organized in 24 countries. The number of students per school has varied between 30 and 50, representing between 5 and 25 different nationalities in the host regions. The current success of the ISYA program is a result of dedicated organization and efforts by a number of individuals under the leadership of the ISYA Director, Jean-Pierre de Greve, and Deputy Director, Kam-Ching Leung. The IAU wishes to establish a robust financial and organizational basis for this highly valued educational program. To this end, the Norwegian Academy of Sciences and Letters' financial contributions to the ISYAs since 2009 allowed the IAU and NASL to establish an Office for Young Astronomers (OYA). The OYA is a virtual office, housed at the NASL in Oslo, Norway, consisting of a Steering Committee with overall responsibility for program operations. An IAU Vice-President chairs the Steering Committee; other members are the ISYA Director and Deputy Director, a representative from NASL, and the President of IAU Division C, Education, Outreach, and Heritage. The objective of this new OYA is to strengthen the overall organization of the ISYAs by functioning as a supporting structure for the Director and working with the local organizers of each individual school. The schools are organized each year by invitation of a host country, and the individual ISYAs are prepared in close collaboration with local organizations. The ISYA Director and the local organizer determine the curriculum for each school, in agreement with the OYA Steering Committee. Strong involvement of the local organizers and community of the individual ISYAs will be essential to ensure positive follow-up and growth afterwards. The establishment of the OYA is one of the latest projects in a history of collaborations between the IAU and the NASL. The IAU Executive Committee has long advised the NASL on appointments of new committee members for the international Kavli Prize in Astrophysics, and the NASL has provided financial support for the ISYAs and for the Young Astronomers Luncheons at recent IAU General Assemblies — including the one at this GA.