

THE NORWEGIAN ACADEMY
OF SCIENCE AND LETTERS

DRAMMENSVEIEN 78, OSLO
THURSDAY, SEPTEMBER 20, 17:30

THE
BIRKELAND
LECTURE 2012

Prof. Dr. PATRICIA H. REIFF

Rice University, Department of Physics & Astronomy
Houston, Texas, USA

**“Mapping and Predicting
the Aurora”**

No registration necessary. Free admission



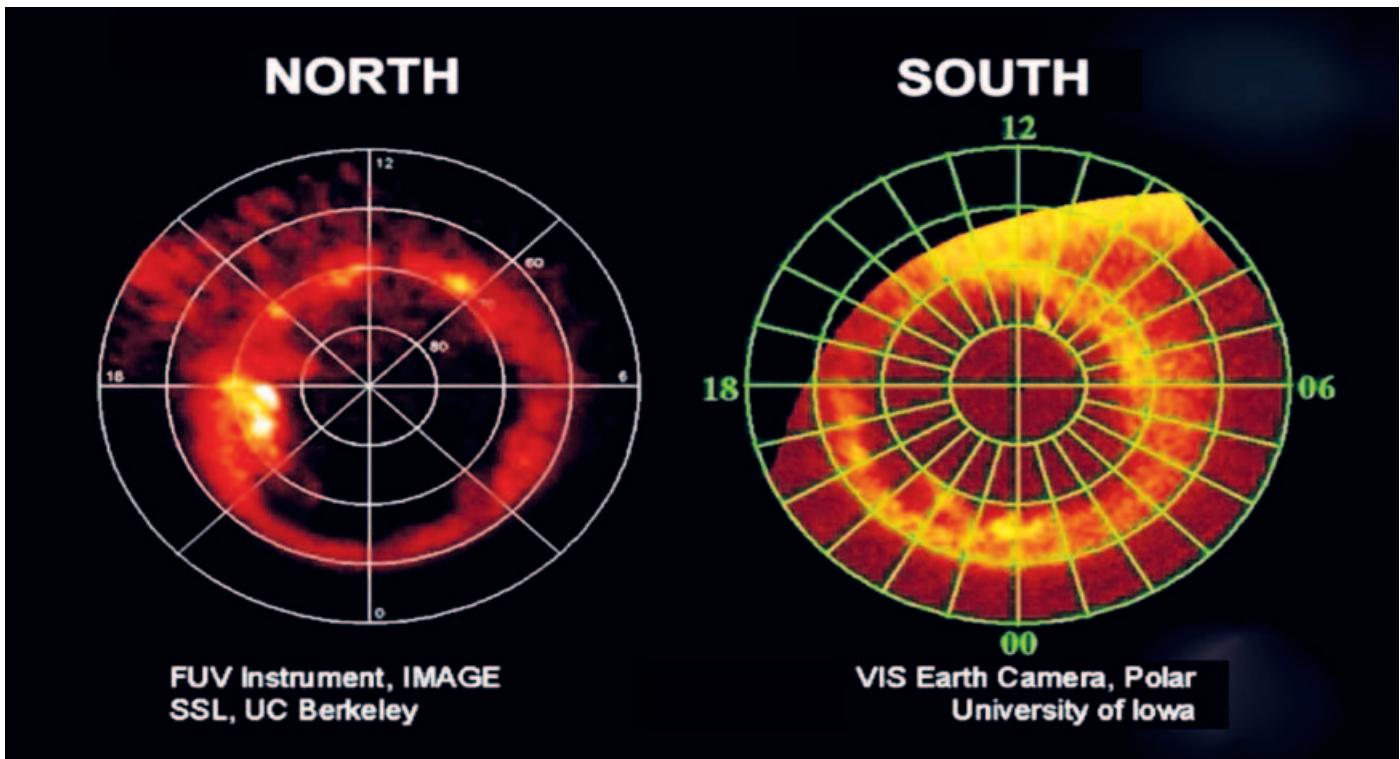
This portrait of Professor Kristian Birkeland was painted by Asta Nørregaard in 1906.

The Birkeland Lecture 1987-2012

This year it is 25 years since the first Birkeland Lecture was given in Oslo by the Nobel Laureate Hannes Alfvén. The lecture was a joint venture by the University of Oslo, the Norwegian Academy of Science and Letters and the Norwegian company Norsk Hydro. In 2004 Yara ASA took the place of Norsk Hydro in the committee and since 2005 the Norwegian Space Centre has been a partner in this cooperation. The Birkeland Lecture is above all an endeavor to honor the great Norwegian scientist and entrepreneur Kristian Birkeland. However, it has also given the organizers an opportunity to invite to Oslo many outstanding scientists within the field of geophysical and space research, areas which were central in Kristian Birkeland's own research.

Except for the year 1993, when the lecture was presented in Tokyo, and in 1998, when a mini-seminar was organized at the Norwegian Embassy in Tokyo, the lectures have been given in Norway, most of them at the Academy's premises in Oslo. Some years seminars have been arranged in connection with the lectures, e.g. in 1993 when the lecture was a part of a "Joint Japanese - Norwegian Workshop on Arctic Research", in 1995 when the lecture was a part of a seminar on Norwegian environmental research, and in 2001 when the lecture was given in connection with a workshop on Norwegian space research, with emphasis on the Cluster satellite programme.

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| 1987: | Hannes Alfvén , Kungliga Tekniska Högskolan , Stockholm, Sverige, and University of California, San Diego, USA:
"The Auroral Research in Scandinavia" | 2002: | Alain F. Roux, Centre d'Etude des Env. Terrestres et Planetaires, CETP, Paris:
"Role of Kristian Birkeland currents in the dynamics of the geomagnetic tail" |
| 1988: | Alex J. Dessler , Rice University, Houston, USA:
"I have it" - Birkeland's quest for research founding"
(University of Oslo, 16. 09 1988) | 2003: | Lev M Zelenyi, Space Research Institute, IKI, Moscow, Russia:
"Space Weather" |
| 1989: | T.A. Potemra, The John Hopkins University, Laurel, USA:
"Satelite measurements of Birkeland currents"
and
Naoshi Fukushima, Tokyo University, Japan:
"Birkeland's work with the geomagnetic disturbances in relation to modern research" | 2004: | Catherine G. Coleman, NASA, Houston, USA:
"Our Earth seen from Space" |
| 1990: | James van Allen , University of Iowa, USA:
"On the future of space science and applications" | 2005: | William J. Burke, Air Force Geophysics Laboratory, USA:
"Kristian Birkelands Message from the Sun - Its meaning then and now" |
| 1991: | Syun-Ichi Akasofu , Geophysical Institute, Fairbanks, Alaska:
"Helio-magnetism" | 2006: | Margaret Kivelson, University of California, Los Angeles (UCLA), USA:
"A century after Birkeland: Auroras and related phenomena at moons and planets" |
| 1992: | W. Ian Axford , Max-Planck Institut, Lindauer, Tyskland:
"The origin of cosmic rays" | 2007: | Egil Friis-Christensen, Danish National Space Center (DTU)
"Unrest on the Sun - storms on the Earth. The magnetic connection" |
| 1993: | Takasi Oguti, Solar-Terrestrial Environment Laboratory, Tokyo, Japan:
"Sun-earth energy transfer" | 2008: | Franz-Josef Lübken, Leibniz-Institut für Atmosphärenphysik, Kühlungsborn, Germany
"Dramatic climate changes in the upper atmosphere" |
| 1994: | Stanley W.H. Cowley, Imperial College, UK:
"The Solar wind - Magnetosphere-Ionosphere connection" | 2009: | Paul M. Kintner, Jr, School of Electric and Computer Engineering, Cornell University, Ithaca, NY, USA
"Extreme space weather" |
| 1995: | Anthony L. Peratt, Los Alamos National Laboratory, USA:
"The legacy of Birkeland's plasma torch" | 2010: | Christer Fuglesang, Science and Application Division, Human Space Flight Directorate, European Space Agency (ESA)
"Voyages to the International Space Station"
- a marvellous platform for research and future space exploration. |
| 1996: | Gerard Haerendel, Max Planck Institute, Garching, Tyskland:
"Physics along auroral magnetic field lines" | 2011: | Ryoichi Fujii, Solar-Terrestrial Environment Laboratory, Nagoya University, Japan
"Long-lasting Norway-Japan collaboration in solar-terrestrial science" |
| 1998: | No lecture, but a "Birkeland event" at Tokyo University 30. 09 with presentation of a Birkeland bust to Tokyo University, and a mini-seminar at the Norwegian Embassy. | | |
| 2001: | David Southwood, Imperial College, London / Director of Research ESA, Paris:
"Kristian Birkeland, Science Forever, Lessons for Today" | | |



Simultaneous auroras over the northern and southern hemispheres, August 17, 2001, 17:48:38 UT

Prof. Dr. Patricia H. Reiff
Rice University, Department of Physics & Astronomy Houston, Texas, USA

“Mapping and Predicting the Aurora”

Advances in understanding, mapping, and even predicting the aurora have made major strides in the past 25 years. From early work by Birkeland and even Benjamin Franklin, to rocket, radar, and spacecraft (particularly multiple spacecraft), we have learned more about the location, acceleration mechanisms, and mapping to the Earth’s magnetotail.

With multiple spacecraft we have been able to show that the “inverted-V” type aurora is indeed caused by auroral acceleration by parallel electric fields, and that diffuse aurora is caused by pitch angle scattering of trapped electrons in the magnetotail.

In addition, “wave accelerated” auroras can also be observed near the boundary between open and closed

magnetic fields. Advances in predicting the aurora go hand in hand with predicting geomagnetic activity indices such as Kp, AE, and Dst.

At Rice University we have developed algorithms based on a neural network using solar wind and Interplanetary Magnetic Field input that can predict Kp, AE and Dst 3 and even 6 hours ahead (<http://mms.rice.edu/realtime/forecast.html>), where users can sign up for a free email notification of events. In parallel, The Johns Hopkins University’s Applied Physics Laboratory has an auroral prediction algorithm that can provide a georeferenced auroral map 45 minutes in advance. We hope to merge the two techniques in the near future, yielding an accurate georeferenced auroral prediction up to 3 hours in advance.

Yara's Birkeland Prize in Physics and Chemistry

Yara's Birkeland Prize in Physics and Chemistry will be awarded to a Ph. D. candidate from a Norwegian university who has carried out a scientific study that is in accordance with the innovative spirit of Kristian Birkeland.

The prize will focus on the environment and technology, and encourage research across the traditional borders. The

prize will alternate between physics and chemistry, with chemistry in years with odd numbers and physics in years with even numbers.

The award ceremony will take place in connection with the Birkeland lecture. The prize was awarded for the first time in 2009.



Professor Dr. PATRICIA H. REIFF **Rice University,** **Department of Physics & Astronomy**

Dr. Patricia Reiff is Associate Director of Outreach, Rice Space Institute, and professor at the Department of Physics and Astronomy at Rice University. She is the founding Director of the Rice Space Institute and has been involved

in space plasma physics research for over 40 years, with interests in the aurora and space weather. She received her Ph.D. in 1975 analyzing Apollo plasma data, and was a Co-Investigator on the Dynamics Explorer, Polar, IMAGE, and Cluster Missions. She is Education and Public Outreach (EPO) lead for the Magnetospheric Multiscale Mission, to be launched in 2014, which provides free realtime space weather alerts to over 850 subscribers.

She has served as Director for public education and teacher enhancement projects for over 20 years. Her "Space Update" software, together with "Earth Update"

and "Space Weather" has been distributed to over 250,000 educators and learners. Her project "Immersive Earth" created full-dome digital planetarium shows, and has created a portable planetarium system "Discovery Dome", which is now in over 160 sites in 30 countries and 29 states. These NASA Cooperative Agreements have spun off two companies, Space Update, Inc. and MTPE to distribute educational materials and portable planetariums.

She has numerous awards, including being named as one of Houston's "Women on the Move" in 1990. She was elected to the Cosmos Club in 1992, a Fellow of the American Geophysical Union in 1997, and the AGU "Athelstan Spilhaus Award" for public education in 2009. She received the "Aerospace Educator Award" from Women in Aerospace in 1999 and NASA "Group Achievement" awards for the IMAGE, GGS and Cluster missions. In addition to training thirteen PhD's, she created a "Master of Science Teaching" degree, with 23 teacher alumni as of 2011.

Organizing committee:

Professor Jan A. Holtet, Department of Physics, University of Oslo

Professor Alv Egeland, Department of Physics, University of Oslo

Øyvind Sørensen, Chief Executive, the Norwegian Academy of Science and Letters

Bernhard Stormyr, Communication Manager, Yara International ASA

Pål Brekke, Senior Advisor, Norwegian Space Centre

The Birkeland Lecture is open for everybody. There is no registration. Free admission.

For more information about the Birkeland Lecture 2012:

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UiO : Universitetet i Oslo



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