

THE NORWEGIAN ACADEMY OF SCIENCE AND LETTERS

DRAMMENSVEIEN 78, OSLO  
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# The BIRKELAND Lecture 2015



## DR. TERRANCE ONSAGER:

National Oceanic and Atmospheric Administration (NOAA)  
Space Weather Prediction Center, USA

## – Our Connection to Space

No registration. Free admission.

PHOTO: NASA

### 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  
*Svein Flatebø*, Senior Adviser, 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 2015:

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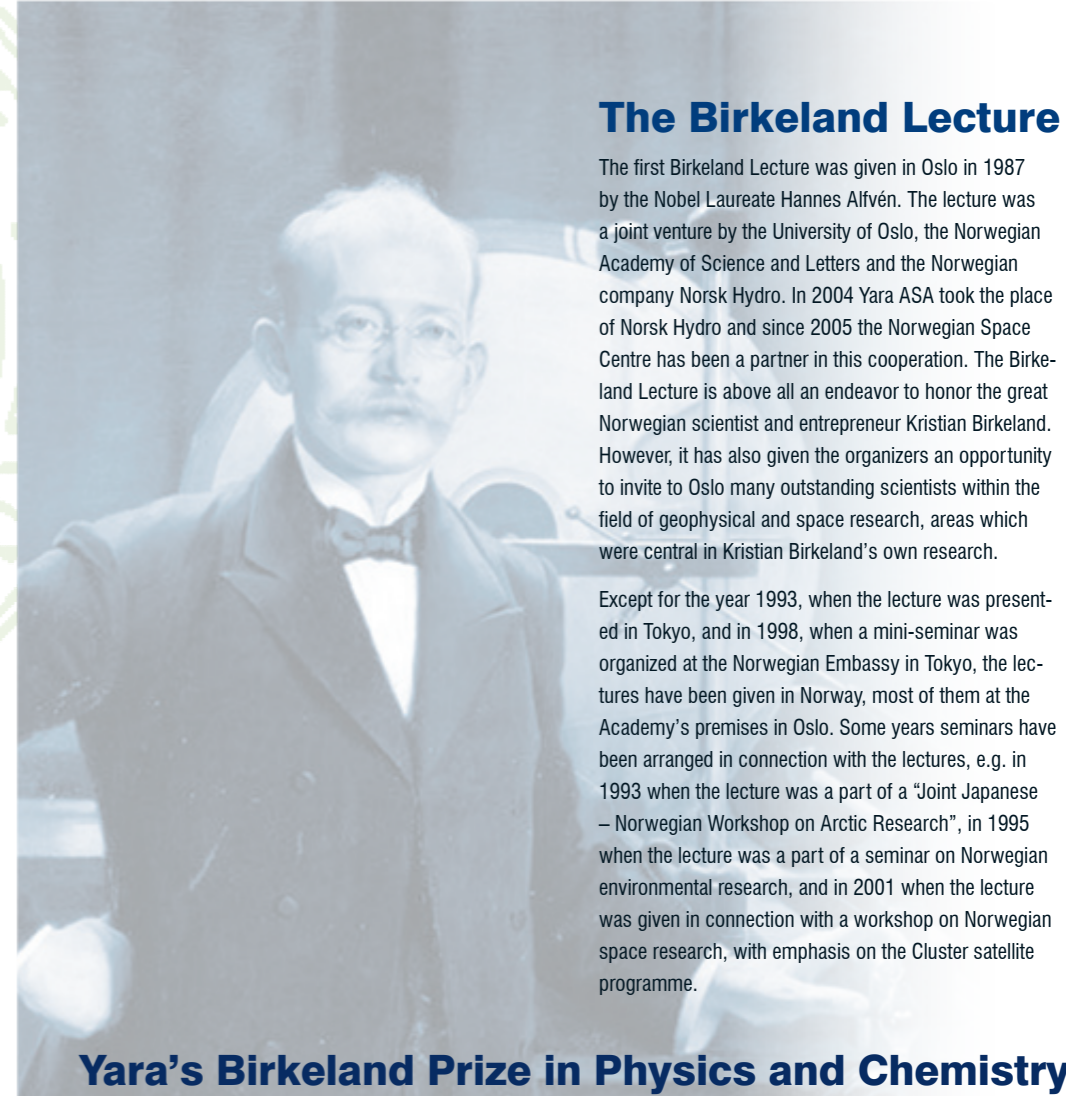
A list of former Birkeland lecturers is found on  
<http://www.dnva.no/artikkel/vis.html?tid=44857>



UiO : Universitetet i Oslo



DET NORSKE  
VIDENSKAPS-AKADEMI



## The Birkeland Lecture

The first Birkeland Lecture was given in Oslo in 1987 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 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.

## Yara's Birkeland Prize in Physics and Chemistry

In 1905, Kristian Birkeland's research formed an important basis for the foundation of the world's first company to manufacture fertilizer on an industrial scale, Norsk Hydro.

Birkeland was a visionary scientist with the ability and commitment to carry out large scale projects in the laboratory and the field, to follow up with theoretical studies, and to see the application of his results. Today Yara carries this heritage forward and takes great pride in being part of the effort to improve food security. A company's continued success depends upon its ability to innovate. To honor the innovative spirit of its cofounder, Yara established the

Birkeland Prize in Physics and Chemistry in 2009.

Yara's Birkeland Prize 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 mind of Kristian Birkeland. The prize has an emphasis on the environment and technology, and encourage research across traditional borders. The prize will alternate between physics and chemistry, with chemistry in odd-numbered years and physics in even-numbered years. The award ceremony will take place in connection with the Birkeland lecture.

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

## Science and Innovation

In 2012 a new section was added to the traditional Birkeland Lecture, an introductory lecture under the thematic umbrella “Science and Innovation”.

This year’s lecture, **SAW Technology – from Science to Industry**, will be given by **Sverre Bisgaard**, former CEO Kongsberg Norspace.

Surface Acoustic Wave (SAW) technology development was pioneered by several universities in the 1960’s and 70’s. NTNU (NTH) in Trondheim became one of the leading institutions in this field. In the mid 80’s the Norwegian company AME decided to utilize this research for space application. During the next decades AME and its successor companies developed a world leading position based on using SAW technology for niche products in satellite payloads. The lecture tells the success story of a company becoming a world leader in its field, based on the research of a Norwegian university.

From a modest start in 1984 with AME space division, Sverre Bisgaard has built up and been the leader of what is now Kongsberg Norspace in Horten, Norway. Under Alcatel ownership from 1989 to 2003 he lead Alcatel Space Norway (ASN) through an international expansion, developing and manufacturing space flight electronic products for satellites, growing the company from 15 to 130 employees.

In 2003, following close-down of ASN by Alcatel, he started Norspace as a privately owned company, which took over the business of ASN. After a successful build-up of Norspace the company was sold to Kongsberg in 2011. He retired from his position as CEO of Kongsberg Norspace in 2015.



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## – Our Connection to Space

Human civilization’s connection to space has evolved profoundly over the past centuries and millennia. For thousands of years our ancestors viewed the aurora and sunspots and acted upon beliefs of messages hidden in these heavenly signs. With the development of sophisticated instruments and the discovery of physical laws, a new era of understanding emerged. People found themselves connected to a vast, natural laboratory, able to measure directly eruptions on the Sun and energetic particles from throughout the galaxy.

It was within this era of understanding that Kristian Birkeland accomplished his pioneering work. Among his many discoveries was the profound and direct connection between Earth and space through the flow of electrical currents. The century since Birkeland’s discoveries has shown remarkable advances in our

ability to observe, to understand, and ultimately to predict the complex physical processes linking Earth to space.

Most recently, the development of modern technology and the global integration of our economic and security infrastructures have connected our daily lives to space in ways previously unimaginable. The electric power grid, air and space travel, satellite operations, and the ubiquitous global navigation systems are all impacted by the dynamics of the space environment, collectively referred to as “space weather.” We are now faced with the challenging imperative to reach beyond our scientific understanding and apply our knowledge, both to safeguard our modern infrastructure and to enable future exploration and utilization of space.

The modern challenge introduced by our growing connection to space now requires a new level of coordination around the globe. Efforts are underway within national governments, private industry, and United Nations organizations to advance our research, coordinate our observing and service networks, and develop civil contingency plans for the possibility of extreme space weather events. Although still at an early stage, exciting progress is being made to build on scientific achievements and to develop the necessary prediction and alerting capabilities. This will ultimately lead to a more effective utilization of space and stronger connections here on Earth.



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Dr. Onsager is a physicist at the Space Weather Prediction Center in Boulder, Colorado and Director of the International Space Environment Service.

Terry Onsager first viewed the aurora while camping in Narvik, Norway at age 17. He subsequently received his Ph.D. in Physics at the University of Washington and conducted research at Los Alamos National Laboratory, the University of New Hampshire, the Institute for Space and Astronautical Science (Japan), and Nagoya University. He joined the Space Weather Prediction Center in 1995.

His education and research career concentrated first on fundamental topics of solar-terrestrial physics and more recently on applying our knowledge of Earth’s space environment to address society’s growing need for real-time space weather information. His career has spanned an exciting transition period during which numerical prediction models of the Sun-Earth system have matured, space-based and ground-based observations have multiplied, and the demand for timely and accurate information on solar eruptions and their consequences has expanded.

As Director of the International Space Environment Services, he leads the coordination of a global network of space weather service-providing organizations. Currently 16 centers around the world provide a range of services, including forecasts, warnings and alerts of solar, magnetospheric, and ionospheric conditions. In addition, he co-chairs the World Meteorological Organization’s Inter-Programme Coordination Team on Space Weather, and he served as a member of the Space Weather Expert Group for the United Nations Committee on the Peaceful Uses of Outer Space Long-Term Sustainability of Outer Space Activities.