THE Crafoord PRIZE

Crafoord *Days* 2016

24–26 MAY IN STOCKHOLM AND LUND, SWEDEN

The Crafoord Prize in Mathematics and Astronomy 2016

Abstracts and Programmes

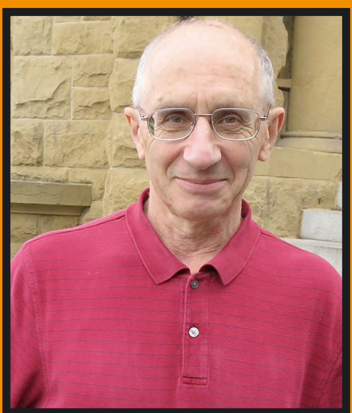


PHOTO: ROSE STAUDER

YAKOV ELIASHBERG

PHOTO: MARGRET KERR

ROY KERR

PHOTO: DAVID STRICKER

ROGER BLANDFORD

Anna-Greta and Holger Crafoord Fund

THE FUND WAS ESTABLISHED in 1980 by a donation to the Royal Swedish Academy of Sciences from Anna-Greta and Holger Crafoord. The Crafoord Prize was awarded for the first time in 1982. The purpose of the fund is to promote basic scientific research worldwide in the following disciplines:

- Mathematics
- Astronomy
- Geosciences
- Biosciences (with particular emphasis on Ecology)
- Polyarthritis (e.g. rheumatoid arthritis)

Support to research takes the form of an international prize awarded annually to outstanding scientists and of research grants to individuals or institutions in Sweden. Both awards and grants are made according to the following order:

year 1: Mathematics and Astronomy
year 2: Geosciences
year 3: Biosciences (with particular emphasis on Ecology)
year 4: Mathematics and Astronomy
etc.

The Prize in Polyarthritis is awarded only when the Academy's Class for medical sciences has shown that scientific progress in this field has been such that an award is justified.

Part of the fund is reserved for appropriate research projects at the Academy's institutes. The Crafoord Prize presently amounts to SEK 6 million.

The Crafoord Prize is awarded by the Royal Swedish Academy of Sciences.

Content

PROGRAMME

LAUREATES

Crafoord *Prize* 2016

The Crafoord Laureate in Mathematics 2016

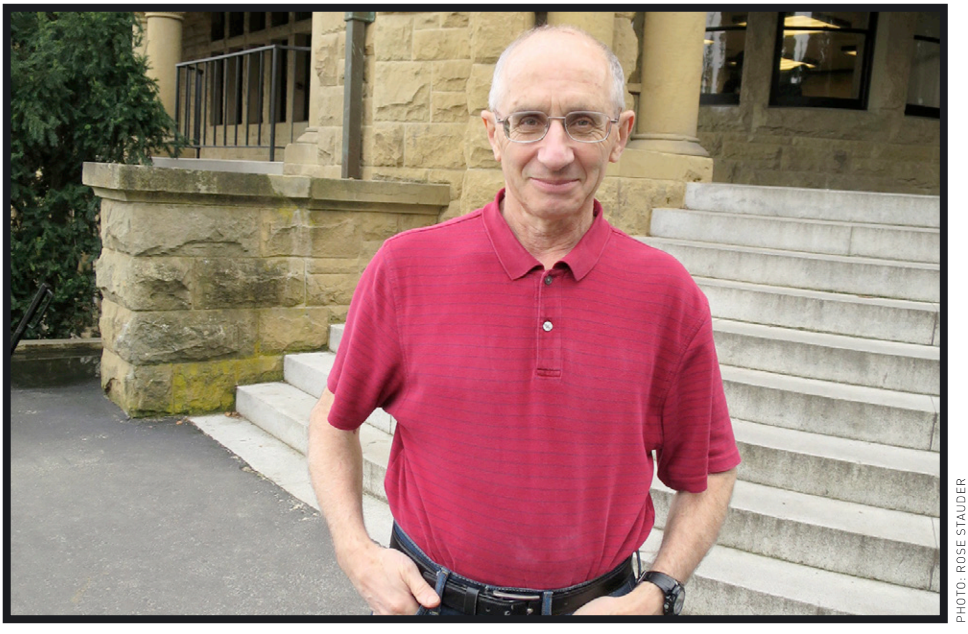


PHOTO: ROSE STAUDER

YAKOV ELIASHBERG, STANFORD UNIVERSITY, CA, USA

Yakov Eliashberg, born 1946 in S:t Petersburg, Russia, Ph.D. at Leningrad State University 1972. Herald L. and Caroline L. Ritch Professor of mathematics at Stanford University, CA, USA, "*for the development of contact and symplectic topology and groundbreaking discoveries of rigidity and flexibility phenomena*".

The Crafoord *Prize* in Mathematics

Yakov Eliashberg is one of the leading mathematicians of our time. For more than thirty years he has helped to shape and research a field of mathematics known as symplectic geometry, and one of its branches in particular – symplectic topology.

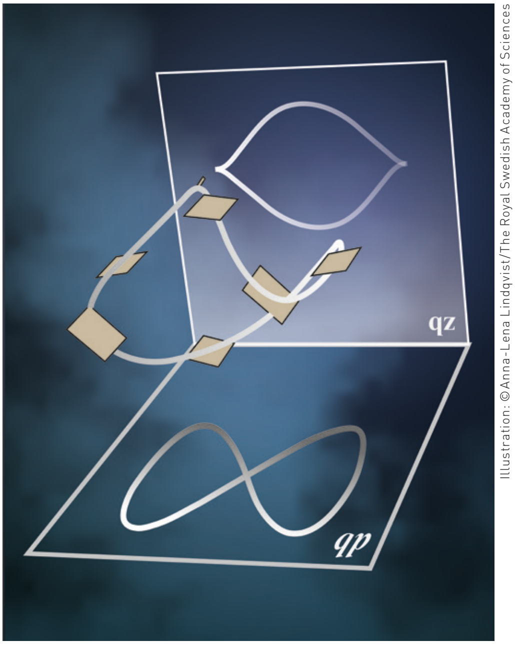


Illustration: ©Anna-Lena Lindqvist/The Royal Swedish Academy of Sciences

Yakov Eliashberg has solved many of the most important problems in the field and found new and surprising results. He has further developed the techniques he used in contact geometry, a twin theory to symplectic geometry. While symplectic geometry deals with spaces with two, four, or other even dimensions, contact theory describes spaces with odd dimensions. Both theories are closely related to current developments in modern physics, such as string theory and quantum field theory.

Symplectic geometry's link to physics has old roots. For example, it describes the geometry of a space in a mechanical sytem, the space phase. For a moving object, its trajectory is determined each moment by its position and velocity. Together, they determine a surface element that is the basic structure of symplectic geometry. The geometry describes the directions in which the system can develop; it describes movement. Physics becomes geometry.

One of Yakov Eliashberg's first and perhaps most surprising results was the discovery that there are regions where symplectic geometry is rigid and other regions where it is completely flexible. But where the boundary is between the flexible and the rigid regions, and how it can be described mathematically, is still a question that is awaiting an answer.

The Crafoord Laureates in Astronomy 2016

PHOTO: MARGARET KERR

ROY KERR, UNIVERSITY OF CANTERBURY, CHRISTCHURCH, NEW ZEALAND

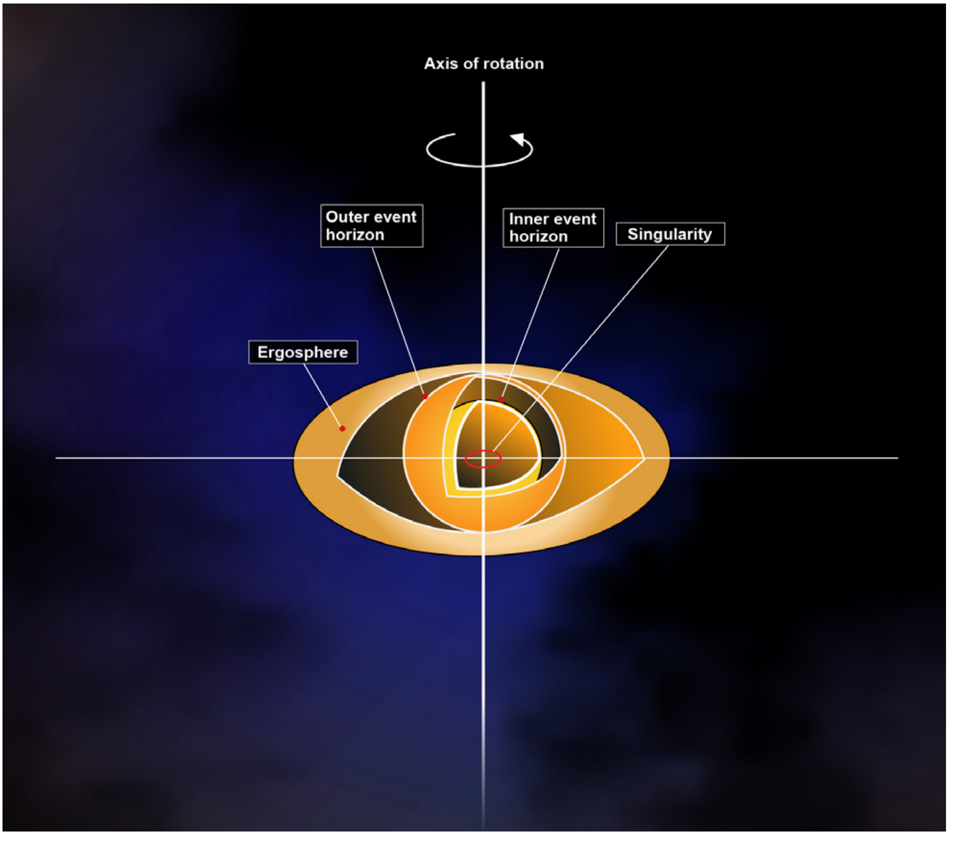
PHOTO: DAVID STRICKER

ROGER BLANDFORD, STANFORD UNIVERSITY, CA, USA

Roy Kerr, born 1934 in Kurow, New Zeeland. Ph.D. 1959 at University of Cambridge, UK. Emeritus Professor at University of Canterbury, New Zeeland and
Roger Blandford, born 1949 in Grantham, UK. Ph.D. 1974 at University of Cambridge, UK. Luke Blossom Professor in the School of Humanities and Sciences, Stanford University, CA, USA, *"for fundamental work concerning rotating black holes and their astrophysical consequences"*.

The Crafoord *Prize* in Astronomy

Illustration: ©Anna-Lena Lindqvist/The Royal Swedish Academy of Sciences



Black holes are the source of the universe's most powerful radiation, as well as of jets that can stretch many thousands of light years out into space. **Roger Blandford's** theoretical work deals with the violent processes behind these phenomena. **Roy Kerr** laid the foundation for this research early on, when he discovered a mathematical description of rotating black holes. This became one of the most important theoretical discoveries in modern cosmology.

The prediction of black holes is one of the perhaps strangest results of the general theory of relativity. When Albert Einstein finally presented his theory, in November 1915, he described gravity as a geometric property of space and time, spacetime.

All objects with mass bend spacetime; they create a pit into which smaller objects can fall. The greater the mass, the deeper the pit. The mass of a black hole is so great that nothing that ends up in there can escape, not even light.

It was not until 1963 that mathematician Roy Kerr succeeded in solving Einstein's equations for rotating black holes. That the holes should rotate is feasible because the stars from which they originated should have rotated. At about the same time, astronomers discovered galaxies that emitted light and other electromagnetic radiation that was so strong it outshone several hundred ordinary galaxies. They were named quasars. Nothing other than a black hole could give the quasars their luminosity.

So how is the strong light of rotating black holes created? This question was answered by Roger Blandford and his colleagues in the 1970s. Ever since, he has refined and made more realistic models of how gas surrounding a black hole flows towards it, is heated up and transforms some of its gravitational energy to radiation. While this is happening, electrically charged particles are sent millions of kilometres into space in the form of powerful jets. The source of all of this power is the rotational energy of the massive black hole.

ABSTRACTS

Crafoord *Days* 2016

Khovanov homology from symplectic topology

IVAN SMITH, UNIVERSITY OF CAMBRIDGE, UK

The Jones polynomial, invented in 1985, is a classical invariant of knots and links in three-dimensional space. A remarkable homological refinement of the Jones polynomial was introduced by Mikhail Khovanov in 1998, based on techniques from combinatorics and from representation theory. The definitions of the Jones polynomial and of Khovanov homology are rather ungeometric, and their topological meaning and significance has remained largely mysterious. In joint work with Paul Seidel and Mohammed Abouzaid, we recently gave a symplectic interpretation of rational Khovanov homology, which gives some new geometric insight into the invariant. The talk will give an overview of this story.

How far symplectic flexibility may go?

YAKOV ELIASHBERG, STANFORD UNIVERSITY, CA, USA

To illustrate the rigid-flexible divide in symplectic topology consider Lagrangian intersection theory, one of the centerpieces of symplectic topology. This theory can be viewed as a generalization of Morse theory, the study of global properties of critical points of functions. Symplectic rigidity results promote this analogy by establishing, for instance, bounds on the number of intersection points of Lagrangian submanifolds in the spirit of Morse inequalities for critical points of a function. On the other hand, flexible methods strive to find the exact limitations of this analogy by providing often counter-intuitive constructions. In the lecture I will describe the recent progress on the flexible side of symplectic topology and discuss some old and new open problems and conjectures on the frontier of symplectic flexibility and rigidity.

The complexity of iterations

PAUL SEIDEL, MASSACHUSETTS INSTITUTE OF TECHNOLOGY, CAMBRIDGE, MA, USA

I will survey results, examples and problems from different areas of mathematics, which concern how the complexity of a map (measured by algebraic invariants) grows under iteration. Focusing on symplectic topology, one finds that most of the resulting questions are completely open, but a few basic observations can be made.

Knot contact homology and Symplectic Field Theory

TOBIAS EKHOLM, UPPSALA UNIVERSITY, SWEDEN

Knot contact homology applies the simplest version of Symplectic Field Theory to the conormal of a knot in the 3-sphere. It gives strong knot invariants that turn out to be intimately related to Chern-Simons gauge theory and topological string theory. From this point of view, representations of knot contact homology into complex numbers gives a semi-classical approximation to the full quantum theory. The full quantum theory should be captured by Legendrian Symplectic Field Theory that gives a new and rather effective description of the physical theories from geometry at infinity of the spaces under consideration. The talk will discuss these ideas in a number of elementary examples.

How mirror symmetry could be used in symplectic geometry

KENJI FUKAYA, STATE UNIVERSITY OF NEW YORK, NY, USA

Mirror symmetry provides many conjectures and theorems, which include both symplectic and complex geometry. Besides its importance in Physics and its own interest, Mirror symmetry is expected to be applicable to the study of symplectic geometry and topology. In this talk I want to explain some of the problems in symplectic geometry to which Mirror symmetry could be applicable. I also want to explain the difficulty to apply it.

Spinning Black Holes

ROY KERR, CANTERBURY, CHRISTCHURCH, NYA ZEELAND

Soon after Einstein published the equations for his General Theory of Relativity Karl Schwarzschild solved these for the gravitational field outside a featureless non-spinning ball. For extreme collapsed objects this contained a spherical surface, the event horizon, from which nothing could escape. If the central body collapses inside this it will be lost forever and its radius will continue to decrease. What happens in the limit we cannot say since classical physics may break down at these ultra high densities. All isolated bodies rotate so many researchers tried to solve the Einstein equations for such a source, hoping to construct a rotating Black Hole. For simplicity most looked for an axial symmetric and time independent solution. The field equations were still highly non-linear and no physical solution was constructed by these direct methods. In the early 1960's two things happened. I was able to construct the metric for any rotating Black Hole (using new methods that had just come into the field) and at the same time Quasars were identified as enormous collapsed objects pumping out energy at an unprecedented rate. It did not take the Astrophysical community long to relate these two.

Engaging the Black Hole

ROGER BLANDFORD, STANFORD UNIVERSITY, CA, USA

In the half century that has elapsed since Roy Kerr discovered the metric that bears his name, we have learned that the spinning black holes that it describes are present in the nuclei galaxies and binary stars including, especially, those recently discovered by LIGO. Massive, classical black holes are fully described by their mass and their spin. These two quantities relate to the two mechanisms – accretion and electromagnetic braking – through which they are observed electromagnetically as active galactic nuclei and X-ray binaries. Recent observations, from radio to gamma ray energies, have led to considerable advances in our understanding of "black hole engineering" and exploration of the spacetime that constitutes the stage on which these cosmic dramas are enacted. With the success of LIGO, ongoing advances in VLBI and incipient capabilities in X-ray and gamma-ray astronomy, the prospects for further discovery and enlightenment are high. This talk will serve as an introduction to some of the subsequent talks and provide an opportunity to describe recent ideas concerning "magnetoluminescence" – the rapid conversion of electromagnetic into radiant energy.

Disturbed Kerr Black Holes

KIP S. THORNE, CALIFORNIA INSTITUTE OF TECHNOLOGY, PASADENA, CA, USA

Perturbations and collisions of Kerr black holes are an ideal venue for exploring geometrodynamics: the nonlinear dynamics of curved spacetime. The keys to these explorations are numerical relativity simulations and gravitational wave observations. To comprehend the numerical simulations, we can visualize the Riemann curvature tensor using two networks of field lines: tidal tendex lines, which depict tidal gravitational forces, and frame-drag vortex lines, which depict differential frame dragging. When black holes collide, these field lines exhibit fascinating patterns and dynamics, which reveal how the collision generates gravitational waves, and how the waves' back-reaction can give the merged black hole a large kick. Also instructive are pseudo-embedding diagrams for visualizing the spacetime metric, and gravitational-lensing simulations, which reveal what the collision would look like to a nearby person or camera. GW150914, the first gravitational wave that LIGO detected, arose from a collision of two Kerr black holes. Most of its signal power was generated when the spacetime dynamics was highly nonlinear, enabling the first observational tests ever of general relativity in this geometrodynamical regime. The nonlinear regime is rather brief unless the final black hole spins rapidly. In that case the incipient gravitational waves are trapped in the long throat near the horizon long enough for nonlinear mode-mode coupling to generate a cascade of energy among modes, and a resulting turbulent-like geometrodynamical behavior. Although the exterior of a disturbed black hole settles down into a final, Kerr form, the interior does not. Perturbation analyses suggest that three singularities arise in the disturbed interior: a chaotic, space like BKL-type singularity, and up-going and down-going shock-like, null singularities.

Black holes and elementary particle physics

GERARD 'T HOOFT, SPINOZA INSTITUUT, UTRECHT, NETHERLAND

The behavior of astronomical black holes, such as the ones that produce gravitational wave signals, can in principle be computed by applying well-known laws of physics. But the known laws of physics also allow for the existence of extremely tiny black holes. Their masses could be as low as a tenth of a milligram or less, while their sizes then enter the range of 10–32 cm or less. These are the scales where new and unknown laws of physics set in. Standard particle physics here leads to contradictions. To unravel those, we are forced to rephrase particle physics laws; particle properties must be reflected in the way they affect the geometric structure of space and time, and by demanding these to agree with the known symmetry structures of the particles, we plan to learn much more both about the sub-atomic particles and about space and time.

The Dynamical Strong-field Regime of General Relativity

FRANS PRETORIUS, PRINCETON UNIVERSITY, NJ, USA

In this talk I will discuss some of the consequences of the recent detection of gravitational waves by the LIGO/Virgo collaboration. The main event heard, GW150914, is consistent with the emission of gravitational waves from the late inspiral, merger and ringdown of two heavy stellar mass black holes. Many aspects of this event are fortuitous and remarkable, and I will discuss what it has taught us about dynamical, strong-field gravity, and what it implies we can further learn over the next few years once LIGO is upgraded to design sensitivity.

Simulations of the Blandford-Znajek Effect for Kerr Black Holes

JONATHAN C. MCKINNEY, UNIVERSITY OF MARYLAND, MD, USA

Simulations of gas accretion onto rotating black holes have provided deep insights into how the rotational energy of black holes is fed back into their surroundings, which affects the accretion disks very near the black hole and affects gas within galaxies very far from the black hole via interaction with relativistic jets and winds.

X-ray Observations of Rotating Astrophysical Black Holes

ANDREW FABIAN, INSTITUTE OF ASTRONOMY, CAMBRIDGE, UK

Half of the emission from luminous accretion onto rapidly spinning, Kerr black holes originates within the innermost 5 gravitational radii (5GM/c^2). If the black hole is of stellar mass, or has a strong corona, then much of the emission is in the X-ray band. Coronal X-ray irradiation of the accretion flow can, through X-ray reflection and reverberation, reveal the properties of the inner flow and the spin of the black hole. The status of such observations will be reviewed and discussed – Kerr black holes with high spin appear to be common. One consequence of the increase in radiative efficiency of accretion with spin is an observational bias in favour of detecting high spin.

Einstein's Symphony, LIGO and the Discovery of Gravitational Waves from a Binary Black Hole Merger

LAURA CADONATI, GEORGIA INSTITUTE OF TECHNOLOGY, ATLANTA, GA, USA

Gravitational waves, ripples in the fabric of space-time produced by catastrophic astrophysical events, are arguably the most elusive prediction of Einstein's theory of General Relativity, so feeble that Einstein himself thought their detection was impossible. Nevertheless, one hundred years later, the Laser Interferometer Gravitational-wave Observatory (LIGO) has announced the observation of gravitational waves produced by the collision of two black holes. This ground-breaking discovery marks the opening of a new window on the Universe and a new era of gravitational wave astrophysics, where gravitational waves will provide new insights into black holes and neutron stars, and maybe even reveal new objects.

In this talk I will describe LIGO and its observations, I will discuss their implications for testing general relativity in the strong field regime and for astrophysics, and I will outline the current plans for future observations by LIGO, Virgo and other gravitational wave detectors over the next few years.

Black Holes as Laboratories for Fundamental Physics

DAVID WILTSHIRE, UNIVERSITY OF CANTERBURY, CHRISTCHURCH, NEW ZEALAND

Rotating black holes are places where we encounter the most extreme physics since the Big Bang, laboratories to test fundamental physics in ways we cannot hope to do experimentally. With new observational advances, including the Event Horizon Telescope and the measurement of gravitational waves from binary black hole mergers, we will have the tools to test general relativity against modifications to gravity, including forms of scalar dark matter, gravastars and other exotica. Binary black hole mergers also potentially provide a new highly accurate distance measure to probe the expansion history of the universe. In this way, rotating black holes may help us to unravel some of our most fundamental mysteries in cosmology: dark matter and dark energy.

The Current and Future View from the Edge

AVERY BRODERICK,UNIVERSITY OF WATERLOO & PERIMETER INSTITUTE FOR THEORETICAL PHYSICS, WATERLOO, ONTARIO, CANADA

Advances across a variety of technological fronts are fueling a revolution in black hole astrophysics. These include a number of electromagnetic probes that have converged on measurements of black hole spin and its consequences. Among these is the creation of a global array of millimeter and sub-millimeter wavelength telescopes that together will produce images of nearby supermassive black holes that resolve their event horizons for the first time. Already observations from an early incarnation of the Event Horizon Telescope has provided strong tests of qualitative elements of black holes. Forthcoming observations promise to probe the nature of strong gravity and, of particular importance in the nascent era of gravitational wave astronomy, its astronomical manifestations.

Overview programme Crafoord *Days* 2016

Tuesday 24 May 09:30–14:15

Prize Lectures In Mathematics and Astronomy

Held by the Crafoord Laureates **Yakov Eliashberg, Roy Kerr** and **Roger Blandford.**

AULAN, KÅRHUSET LTH, JOHN ERICSSONS VÄG 3, LUND, SWEDEN.
No registration.

Wednesday 25 May 09:30–17:00

Prize Symposium in Mathematics
Contact and symplectic topology

Lectures by the Crafoord Prize Laureate **Yakov Eliashberg** and invited speakers.

HALL D1, KTH CAMPUS, LINDSTEDTSVÄGEN 17, STOCKHOLM, SWEDEN.
Registration at www.crafoordprize.se or http://kva.se

Wednesday 25 May 09:00–17:30

Prize Symposium in Astronomy
Rotating black holes and their astrophysical consequences

Lectures by the Crafoord Prize Laureates **Roy Kerr** and **Roger Blandford** and invited speakers.

THE OSKAR KLEIN AUDITORIUM, ALBANOVA UNIVERSITY CENTER, ROSLAGSTULLSBACKEN 21, STOCKHOLM.
Registration at www.crafoordprize.se or http://kva.se

Thursday 26 May 16:30–17:30

Prize award ceremony

In the presence of his Majesty H.M. King Carl XVI Gustaf of Sweden.

THE BEIJER HALL, THE ROYAL SWEDISH ACADEMY OF SCIENCES, LILLA FRESCATIVÄGEN 4A, STOCKHOLM
Registration at www.crafoordprize.se or http://kva.se

Detailed programme

THE CRAFOORD PRIZES IN MATHEMATICS AND ASTRONOMY 2016

The Crafoord Prize Lectures in Mathematics and Astronomy

09:30–14:15

AULAN, KÅRHUSET LTH,
JOHN ERICSSONS VÄG 3, LUND, SWEDEN.

Open to the public and free of charge. Seating is limited. No registration. For more information please visit http://kva.se/crafoordlectures2016

Tuesday 24 May

09:30	Introduction of the Crafoord Prize	*Arne Ardeberg*, Lund University, Sweden
09:40	Introduction of Yakov Eliashberg	*Tobias Ekholm*, Uppsala University, Sweden
09:50	*Rigid and Flexible Facets of Symplectic Topology*	CRAFOORD LAUREATE 2016 ***Yakov Eliashberg***, Stanford University, CA, USA
10:45	Break with refreshments	
11:15	Introduction of Roger Blandford	*Arne Ardeberg*, Lund University, Sweden
11:25	*Revealing the Black Hole*	CRAFOORD LAUREATE 2016 ***Roger Blandford***, Stanford University, CA, USA
12:20	Lunch	*Tobias Ekholm*, Uppsala University, Sweden
13:10	Introduction of Roy Kerr	*Arne Ardeberg*, Lund University, Sweden
13:20	*Spinning Black Holes*	CRAFOORD LAUREATE 2016 ***Roy Kerr***, University of Canterbury, Christchurch, New Zealand
14:15	Closing remarks	

Detailed programme

THE CRAFOORD PRIZE SYMPOSIUM IN MATHEMATICS 2016

Contact and symplectic topology

09:30–17:00

HALL D1, KTH CAMPUS,
LINDSTEDTSVÄGEN 17, STOCKHOLM, SWEDEN

Open to the public and free of charge. Seating is limited.
Registration is required and must be made before 18 May 2016
at http://kva.se/crafoordmathematics

Wednesday 25 May

09:30	Opening	*Göran K. Hansson*, Secretary General, the Royal Swedish Academy of Sciences
09:35	*Khovanov homology from symplectic topology*	*Ivan Smith*, University of Cambridge, UK
10:35	Break with refreshments	
10:50	*How far symplectic flexibility may go?*	CRAFOORD LAUREATE 2016 ***Yakov Eliashberg***, Stanford University, CA, USA
12:00	Lunch	(Included for registered participants)
13:30	*The complexity of iterations*	*Paul Seidel*, Massachusetts Institute of Technology, Cambridge, MA, USA
14:30	*Knot contact homology and Symplectic Field Theory*	*Tobias Ekholm*, Uppsala University, Sweden
15:30	Break with refreshments	
16:00	*How mirror symmetry could be used in symplectic geometry*	*Kenji Fukaya*, State University of New York, NY, USA
17.00	End of the symposium	

Detailed programme

THE CRAFOORD PRIZE SYMPOSIUM IN ASTRONOMY 2016

Rotating black holes and their astrophysical consequences

09:00–17:30

OSKAR KLEIN AUDITORIUM,
ALBANOVA UNIVERSITY CENTER,
ROSLAGSTULLSBACKEN 21, STOCKHOLM

Open to the public and free of charge. Seating is limited.
Registration is required and must be made before 18 May 2016 at http://kva.se/crafoordastronomy

Wednesday 25 May

09:00	Opening	*Göran K. Hansson*, Secretary General, the Royal Swedish Academy of Sciences
09:05	*Spinning Black Holes*	CRAFOORD LAUREATE 2016 ***Roy Kerr***, University of Canterbury, Christchurch, New Zealand
09:50	*Engaging the Black Hole*	CRAFOORD LAUREATE 2016 ***Roger Blandford***, Stanford University, CA, USA
10:30	Break with refreshments	
10:50	*Disturbed Kerr Black Holes*	*Kip S. Thorne*, California Institute of Technology, Pasadena, CA, USA
11:35	*Black Holes and Elementary Particle Physics*	*Gerard't Hooft*, Spinoza Instituut, Utrecht, Netherland
12:15	Lunch	(Included for registered participants)
13:15	*The Dynamical Strong-field Regime of General Relativity*	*Frans Pretorius*, Princeton University, NJ, USA
13:55	*Simulations of the Blandford-Znajek Effect for Kerr Black Holes*	*Jonathan C. McKinney*, University of Maryland, MD, USA
14:35	*X-ray Observations of Rotating Astrophysical Black Holes*	*Andrew Fabian*, Institute of Astronomy, Cambridge, UK
15:15	Break with refreshments	
15:30	*Einstein's Symphony, LIGO and the Discovery of Gravitational Waves from a Binary Black Hole Merger*	*Laura Cadonati*, Georgia Institute of Technology, Atlanta, GA, USA
16:10	*Black Holes as Laboratories for Fundamental Physics*	*David Wiltshire*, University of Canterbury, Christchurch, New Zealand
16:50	*The Current and Future View from the Edge*	*Avery Broderick*, University of Waterloo & Perimeter Institute for Theoretical Physics, Waterloo, Ontario, Canada
17.30	End of the symposium	

Anna-Greta and Holger Crafoord

Holger Crafoord (1908–1982) was prominent in Swedish industry and commerce. He began his career with AB Åkerlund & Rausing and devoted a larger part of his working life to this company. In 1964, Holger Crafoord founded Gambro AB in Lund, Sweden, where the technique of manufacturing the artificial kidney was developed. This remarkable dialyser soon became world famous. Since then, a series of medical instruments has been introduced on the world market by Gambro.

HOLGER AND ANNA-GRETA CRAFOORD

In 1980, Holger Crafoord founded the Crafoord Foundation, which annually contributes greatly to the Anna-Greta and Holger Crafoord Fund.

Holger Crafoord became an honorary doctor of economics in 1972 and in 1976 an honorary doctor of medicine at the University of Lund.

Anna-Greta Crafoord (1914–1994) took, as Holger Crafoord's wife, part in the development of Gambro AB. Through generous donations and a strong commitment in the society around her, she contributed to the scientific and cultural life. In 1986 she founded the Anna-Greta Crafoord foundation for rheumatological research and in 1987 Anna-Greta Crafoord became an honorary doctor of medicine at the University of Lund.

Over the years, the Crafoords have furthered both science and culture in many ways and it is noteworthy that research in the natural sciences has received an important measure of support from the Anna-Greta and Holger Crafoord Fund.

THE ROYAL SWEDISH ACADEMY OF SCIENCES is an independent, nongovernmental organization whose aim is to promote the sciences and strengthen their influence in society. Traditionally, the Academy takes a special responsibility for the natural sciences and mathematics, and strives to increase exchanges between various disciplines.

The activities of the Academy are aimed mainly at

- spreading knowledge of discoveries and problems in current research
- providing support for young researchers
- rewarding outstanding contributions in research
- stimulating interest in mathematics and the natural sciences in schools
- spreading scientific and popular-scientific information in various forms
- offering unique research environments
- maintaining contact with foreign academies, learned societies and other international scientific organisations
- representing the sciences in society
- carrying out independent analyses and evaluations based on scientific grounds on issues of importance for society

THE ACADEMY HAS has about 450 Swedish members and 175 foreign members. The Swedish members are active within Classes and committees. They initiate investigations, responses to government proposals, conferences and seminars. Once a month, the Academy holds a General Meeting, with a connected public lecture.

THE ACADEMY´S OWN INSTITUTES offer unique research environments for botany, ecological economics, the history of science and mathematics.

IN ADDITION TO THE CRAFOORD PRIZE, the Academy annually awards a number of prizes, the best known of which are the Nobel Prizes in Physics and Chemistry and the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel. Others are the Söderberg Prize and the Göran Gustafsson Prize. The latter are awarded to outstanding young researchers and are a combination of a personal prize and a research grant. The Academy also supports researchers through scholarships and mentoring programmes, and is engaged in appointing many promising young researchers to long-term positions that are financed by foundations.

THROUGH ITS VARIOUS COMMITTEES, the Academy also works for the development of a society based on scientific grounds. Great interest in environmental and educational issues has resulted in a wide variety of Academy activities in these areas.

KUNGL. VETENSKAPS-AKADEMIEN

THE ROYAL SWEDISH ACADEMY OF SCIENCES

THE CRAFOORD PRIZE IS AWARDED BY
THE ROYAL SWEDISH ACADEMY OF SCIENCES

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