THE Crafoord PRIZE

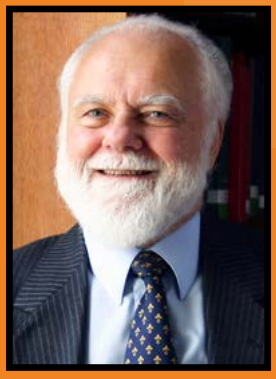
Crafoord *Days* 2024

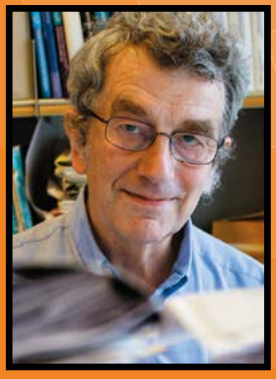
13–16 MAY IN LUND AND STOCKHOLM, SWEDEN

The Crafoord *Prize* in Mathematics and Astronomy 2024

Abstracts and Programmes


CLAIRE VOISIN


DOUGLAS GOUGH


JØRGEN CHRISTENSEN-DALSGAARD


CONNY AERTS

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 6 million Swedish krona.

The Crafoord Prize is awarded in partnership between the Royal Swedish Academy of Sciences and the Crafoord Foundation in Lund. The Academy is responsible for selecting the Crafoord Laureates.

ÅTTA45, JÄRFÄLLA 2024
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The Crafoord Laureate in Mathematics 2024

PHOTO: PATRICK IMBERT, COLLÈGEDEFRANCE

CLAIRE VOISIN
INSTITUT DE MATHÉMATIQUES DE JUSSIEU, FRANCE

Claire Voisin, Institut de Mathématiques de Jussieu, France

"for outstanding contributions to complex and algebraic geometry, including Hodge theory, algebraic cycles, and hyperkähler geometry".

The Crafoord *Prize* in Mathematics

Describing shapes which are impossible to visualise

Algebraic geometry deals with geometric shapes and structures that can be described as solutions to algebraic equations. Unlike the elementary geometry studied at school, these shapes are often impossible to visualise, and algebraic geometry has developed into one of modern mathematics most theoretically demanding areas.

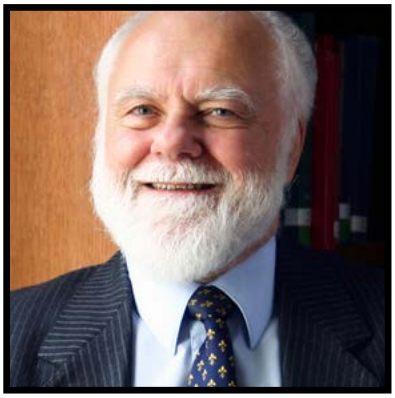
Claire Voisin has provided important and highly acclaimed contributions in this field, through both counterexamples and strongly positive results for some of the most famous unsolved problems.

One such example is the Kodaira problem, about which geometric shapes of higher dimensions that can be described by equations.

Throughout her career, she has also been the leading researcher on the Hodge conjecture, one of the seven Millennium Problems. Recently, she has developed a spectacular method for determining whether geometric shapes are rational, which means they are among the simplest ones. She is also leading in the field of hyperkähler geometry.

The Crafoord Laureates in Astronomy 2024

PHOTO: INSTITUTE OF ASTRONOMY



DOUGLAS GOUGH,
UNIVERSITY OF CAMBRIDGE, UK

PHOTO: RASMUS ROERBAEK

JØRGEN CHRISTENSEN-DALSGAARD,
AARHUS UNIVERSITY, DENMARK

PHOTO: ROB STEVENS

CONNY AERTS,
KU LEUVEN, BELGIUM

Douglas Gough, University of Cambridge, UK, **Jørgen Christensen-Dalsgaard**, Aarhus University, Denmark and **Conny Aerts**, KU Leuven, Belgium,

"*for developing the methods of asteroseismology and their application to the study of the interior of the Sun and of other stars*".

The Crafoord *Prize* in Astronomy 2024

Methods that reveal the secrets inside the Sun and stars

Seismologists learn about the interior of the Earth by studying how it shakes during earthquakes. The three laureates have discovered that similar methods can also be used in astronomy. The interior of the Sun and stars can be investigated by studying movements on their surfaces, caused by internal oscillations that are similar to soundwaves. This is called asteroseismology.

When **Douglas Gough** started his theoretical work, he focused on the Sun and soon had the assistance of his doctoral student, **Jørgen Christensen-Dalsgaard**. He and hundreds of other researchers established a network called the GONG telescopes. This resulted in entirely new discoveries, such as how the interior of the Sun rotates differently to its outer layer.

Conny Aerts used the same method to learn more about distant stars. Thanks to this new technology, researchers are now able to measure the radius of stars and the composition of their interiors and to give them a more precise age.

ABSTRACTS IN MATHEMATICS

Crafoord *Days* 2024

On the smoothability of cycles in the Whitney range

CRAFOORD LAUREATE 2024 **CLAIRE VOISIN**
INSTITUT DE MATHÉMATIQUES DE JUSSIEU, FRANCE

We prove that for any smooth projective variety X over a field of characteristic 0, any cycle of dimension d on X can be written modulo rational equivalence as an integral combination of classes of smooth subvarieties, assuming the Whitney condition 2d<dim X. This follows from a more general theorem: any cycle (of any dimension) on X can be obtained by pushing-forward a product of divisors on a smooth projective variety Y under a flat projective morphism Y-> X. This is joint work with J. Kollár.

The algebra of symmetric tensors

ARNAUD BEAUVILLE
UNIVERSITÉ CÔTE D'AZUR, FRANCE

For a smooth projective variety X over C, the global sections of the symmetric algebra of the tangent bundle form a C-algebra S(X), which has been little studied up to now. I will show through a series of examples that this algebra is both interesting and difficult to calculate. I'll end with a theorem that bounds its (Krull) dimension in terms of the Kodaira dimension of X (joint work with Jie Liu).

Nonsmoothable cycles on algebraic varieties

OLIVIER DEBARRE
UNIVERSITÉ PARIS CITÉ, FRANCE

In 1961, Borel and Haefliger asked whether, in the integral cohomology of a smooth projective algebraic variety of dimension n, the class of every algebraic subvariety of dimension d is a linear combination, with integral coefficients, of classes of smooth subvarieties. Kollár and Voisin recently proved that this is true (in characteristic zero) in the Whitney dimension range, that is, whenever $2d<n$. Outside this range, counterexamples were first produced by Hartshorne, Rees, and Thomas in 1974. I will present some new examples. One example has $2d=n$; another example has $n=6$ (the smallest possible dimension for a counterexample) and $d=4$. This is joint work with Olivier Benoist.

Moduli spaces of twisted sheaves and applications

DANIEL HUYBRECHTS
UNIVERSITÄT BONN, GERMANY

The Picard group and the Brauer group are invariants of a variety that are linked to Hodge structures of weight resp. two. We will discuss analogies between these two and highlight their differences. In particular, we will explain how to use moduli spaces of sheaves with respect to a fixed Brauer class to address splitting properties.

Curves on powers of hyperelliptic Jacobians

STEFAN SCHREIEDER
LEIBNIZ UNIVERSITÄT HANNOVER, GERMANY

For a curve of genus at least four which is either very general or very general hyperelliptic, we classify all ways in which a power of its Jacobian can be isogenous to a product of Jacobians of curves. As an application, we show that, for a very general principally polarized abelian variety of dimension at least four, or the intermediate Jacobian of a very general cubic threefold, no power is isogenous to a product of Jacobians of curves. This confirms some cases of the Coleman-Oort conjecture. We further deduce from our results some progress on Voisin's question whether the integral Hodge conjecture fails for such abelian varieties. This is joint work with Olivier de Gaay Fortman.

ABSTRACTS IN ASTRONOMY

Crafoord *Days* 2024

Asteroseismology of fast rotators

CRAFOORD LAUREATE 2024 CONNY AERTS
KU LEUVEN, BELGIUM

In this talk, Conny Aerts will introduce another regime of asteroseismology, characterised by a strong interplay between convection, rotation, and possible magnetic fields deep inside massive stars. We highlight the importance of the Coriolis and centrifugal forces in the description of the oscillations. We discuss how gravito-inertial oscillation modes allow us to estimates the internal rotation and chemical mixing in the transition layer between the convective core and the radiative envelope. This mixing has major consequences for the chemical yields and galactic evolution.

In the second part of the talk, we move on to tidal asteroseismology and highlight the major advances in the detection capabilities for stellar oscillations in the presence of strong tides. We end the talk with exciting opportunities from 'industrialised' applications from data-driven asteroseismic modelling based on the integrated exploitation of the ongoing NASA TESS and future ESA PLATO space missions, Gaia astrometry, and ground-based spectroscopic surveys including the fastest rotators in the Milky Way and beyond.

Asteroseismology of evolved solar-like stars

CRAFOORD LAUREATE 2024 **JØRGEN CHRISTENSEN-DALSGAARD**
AARHUS UNIVERSITY, DENMARK

The oscillations studied in the Sun are acoustic modes. A major breakthrough in the study of stars with solar-like oscillations has been the identification of mixed modes in stars in later evolutionary stages. These modes have the character of acoustic waves in the outer parts of the star and internal gravity waves in the deeper interior. As such they are much more sensitive than the purely acoustic modes to the structure and dynamics of the stellar core. Such modes were identified in early ground-based detections of solar-like oscillations in other stars, but their diagnostic potential has been dramatically documented by space-photometric observations.

Extensive observations of red-giant stars by the Kepler mission has shown that one can distinguish between stars just burning hydrogen in a shell around a helium core and stars that in addition have helium fusion in the core. Also, it has been possible to determine the rotation rate of stellar cores, in striking contrast to theoretical predictions, and recent analyses have demonstrated the presence of strong magnetic fields in the deep interior of some of these stars.

Mixed modes also play a major role in the seismology of subgiant stars, in the phase just following the exhaustion of central hydrogen. Here they promise detailed investigations of the uncertain mixing processes in stellar cores, of crucial importance to the determination of stellar ages, and allow studies of the evolution of internal stellar rotation also in these earlier phases.

Physics from the Sun

CRAFOORD LAUREATE 2024 **DOUGLAS GOUGH**
UNIVERSITY OF CAMBRIDGE, UK

Aside from its intrinsic interest, the Sun is important to astrophysicists firstly because it is a benchmark from which we can branch out to investigate properties of other stars, and secondly as an accessible laboratory in which we can learn aspects of the physics of the solar material under stable conditions that can be experienced in no other place. My two colleagues will address the first of these, I shall address the second, both through seismological investigation. The Sun is opaque to light. But it is transparent to acoustic waves, which transport to the surface information about the Sun's interior through which they have passed. I shall describe briefly how that information is decoded to reveal the manner in which sound speed, which is closely related to temperature, varies between the solar surface and the core, where it imposes a serious constraint on neutrino production. A detailed analysis of the stratification of the Sun's outer layers permits an evaluation of the helium abundance, and promises a determination of the abundances of some of the most common heavy elements, such as C, O and Ne. It also provides information about the physics of the thermodynamical state. Doppler shifting of acoustic frequencies reveals the underlying fluid motion throughout the Sun's interior. I shall concentrate on the largest spatial scale, namely rotation, for that is accessible to asteroseismology, enabling a comparison of the angular velocities of stellar surfaces with the rotation of the deep interiors, raising important dynamical questions. In the case of the Sun, one can compute the induced quadrupole moment of the gravitational potential, which, coupled with orbital measurements of Mercury and spacecraft, confirms a crucial prediction of Einstein's General Theory of Relativity.

Intermediate-mass stars as physics laboratories

MARGARIDA CUNHA
UNIVERSIDADE DO PORTO, PORTUGAL

Intermediate-mass stars stand out as unique physics laboratories due to the diversity and range of physical phenomena they exhibit. With rotation spanning from extremely slow to fast, a chemical composition that ranges from highly peculiar to normal, and magnetic fields varying from very strong to undetectable, these stars provide exceptional conditions for advancing our studies in crucial aspects of stellar physics. Exploring these stars further contributes to enhancing our models of stellar evolution. In this presentation, I will delve into recent findings from studies of intermediate-mass stars and address the key challenges they continue to present.

Helioseismology with inertial modes

LAURENT GIZON
MAX PLANCK INSTITUTE FOR SOLAR SYSTEM RESEARCH AND UNIVERSITY OF GÖTTINGEN, GERMANY

The modes of stellar oscillation are broadly classified into two categories. The spheroidal modes of oscillation have both horizontal and radial motions and include the solar acoustic modes, which have been used very successfully to probe the Sun's sound-speed profile and differential rotation in the convection zone. In the presence of rotation, toroidal modes of oscillation also exist. The toroidal modes are predominantly associated with horizontal motion and are best described on the surface by their radial vorticity eigenfunctions. The toroidal modes have periods in the inertial range, i.e. of order the rotation period of the star, and have been detected on some distant stars. In the special case of uniform rotation, the modes are retrograde Rossby modes restored by the Coriolis force. The recent unambiguous detection of several classes of global inertial modes on the Sun provides new possibilities for probing the solar interior. These inertial modes, especially the high-latitude modes, are very sensitive to the differential rotation and to properties of the deep solar convection zone which are currently poorly constrained. These properties include the superadiabatic temperature gradient, the turbulent viscosity, and the latitudinal entropy gradient. The inertial modes also play a key role in controlling the Sun's large-scale structure and dynamics, in particular the solar latitudinal differential rotation. The field of inertial-mode helioseismology is in its infancy, and we anticipate it will follow the path set by acoustic-mode helioseismology, solving some outstanding problems and raising new ones. This lecture summarises recent observations and models of solar inertial modes.

Internal structures of low-mass stars

SASKIA HEKKER
HEIDELBERG INSTITUTE FOR THEORETICAL STUDIES, GERMANY

Over the past 20 years, it has become possible – through the observation of solar-like oscillations – to look inside thousands of low-mass stars at different epochs along their evolution. Solar-like oscillations are stochastically excited and damped by turbulent convection and are thought to be present in all low-mass stars. This ringing of the stars is the most direct measure of the internal stellar structure. The glimpses inside the stars this ringing provides reveal in some cases surprising discrepancies between the physics we include in our models and reality. In other cases, these observations confirm our current physical understanding. In this contribution, I discuss the current state-of-the-art of solar-like oscillators, open questions and potential new avenues to answer these open questions.

Insights into the interiors of massive stars

GEORGES MEYNET
GENEVA UNIVERSITY, SWITZERLAND

Massive stars are very efficient cosmic engines responsible for a large part of the chemical and photometric evolution of galaxies. Their short lifetimes, the fact that they may lose large amounts of their mass by stellar winds and/or at the time of their supernova explosion make them key agents for enriching the interstellar medium in new synthesized elements. They are also sources of turbulence impacting the subsequent episodes of star formation. Their high luminosities make them observable in distant galaxies. They are also at the origin of extremely energetic events as core collapse supernovae, pair instability supernovae, gamma ray bursts… They are the progenitors of fascinating object as the neutron stars and the stellar black holes. To know the way they are formed, they evolve and terminate their nuclear lifetime is thus important for many topical questions in astrophysics. To unveil their origin and destiny, it is important to get pieces of information about the physical mechanisms occurring in their interiors. Convection, rotationally triggered turbulence in radiative zones, waves not only transport angular momentum but also impact their chemical structures deeply affecting their evolution and final fates. In this presentation I shall discuss how the observations of different features at their surface (luminosity, colors, gravity, rotation velocity, chemical composition, pulsations, oscillations), of their explosion, or of the characteristics of the stellar remnant allow to probe their interiors providing clues about the physics of convection, rotation and nuclear physics. I shall discuss some intriguing cases as the star gamma Columbae whose special properties can only be explained if some interaction with a nearby companion has occurred, and the case of Betelgeuse whose pulsation properties may indicate that this star is not far from its final core collapse.

The importance of asteroseismology in the study of the Milky Way as a galaxy

ANDREA MIGLIO
UNIVERSITÀ DI BOLOGNA, ITALY

Our understanding of the formation and evolution of the Milky Way and galaxies is often blurred and biased by the lack of precise and accurate stellar ages. Asteroseismology, i.e., the study of global, resonant oscillation modes in stars, is providing us with a formidable tool to unveil detailed insights into the internal structure of stars, paving the path for robust age determinations.

In this presentation, I'll start with a quick look at how asteroseismology has evolved as a tool for studying the Milky Way and stellar populations. Then, I'll dive into current efforts and new discoveries focused on refining our grasp of stellar physics and on providing precise and accurate age estimates for stars in regions surveyed by space telescopes such as Kepler, K2, CoRoT, and TESS.

The availability of asteroseismic constraints has enabled a high-temporal-resolution view of Galactic stellar populations, allowing not only to constrain dynamical processes within the disc, but also serving as a clock to connect observations of high-redshift galaxies with local fossils, which trace the early assembly history of the Galaxy.

While I will showcase examples illustrating asteroseismology's role in reconstructing the Milky Way's formation and evolution, I will also highlight the limitations we encounter, emphasising that these hurdles can only be truly overcome via an improved understanding of stellar physics.

A high-resolution view of solar oscillations and waves

JAIME DE LA CRUZ RODRIGUEZ
STOCKHOLM UNIVERSITY, SWEDEN

The outer layers of the Sun, the photosphere, chromosphere and corona, are shaped by a complex balance between gravity, magnetic forces and forces originating from gas pressure gradients. The resulting stratification is very dynamic and finely structured. Waves are excited by convection and propagate through these three layers where the gas density drops by more than seven orders of magnitude from the photosphere to the corona. In this lecture I will show the observational imprint that waves and shocks leave in the outer layers of the Sun from observations acquired at the highest spatio-temporal resolution that is available to us.

Furthermore, the chromosphere is not in radiative equilibrium with the photosphere: it is much hotter than radiative equilibrium models predict, which raises the long-standing question of "what is heating the outer layers of the Sun". Waves play a fundamental role in the transport of energy from the photosphere to the chromosphere, where this energy can be dissipated. Using results from advanced empirical models, I will show the connection of waves and shocks to the chromospheric heating problem.

The evolution of massive stars, single and binary

HUGUES SANA
KU LEUVEN, BELGIUM

Massive stars are fundamental cosmic engines that have fed energy and chemical elements into the interstellar medium since cosmic dawn. They end their short but energetic life in powerful explosions, leaving behind compact remnants, neutron stars and black holes, that have fascinated physicists and the public alike for many decades. Massive stars are at the core of many fields of astrophysics, from the epoch of cosmic reionization, and the first stars and galaxies, to the merging of compact objects and gravitational wave events. Yet, our understanding of their life cycle remains insufficient, an uncertainty that impact current models of galaxy evolution, of distribution of matter in the universe or predictions of gravitational wave merger rates. In this talk, I will summarize how observational breakthroughs have shaped our modern view of the formation, evolution and final fates of massive stars, single and binaries, and how future observational facilities and new computational techniques can be used to solve some of the important challenges that we face in understanding the physics of high-mass stars.

Understanding exoplanets through asteroseismology

VINCENT VAN EYLEN
UNIVERSITY COLLEGE LONDON, UK

Over the past 30 years more than 5000 exoplanets have been discovered. I explain how these planets, which orbit distant stars, are observed: the vast majority of exoplanets are detected indirectly, with their presence inferred from the way they influence the star around which they orbit. As a consequence, almost everything we know today about exoplanets is directly linked to our understanding of stars. I explain how many breakthroughs in exoplanet science have been a direct result of an improved understanding of stellar physics, with asteroseismology widely considered the gold standard in this regard. I show how asteroseismology has therefore played a unique role in shaping the field of exoplanet science, and how asteroseismology can be used to characterise host stars and their planets. I review what has been learned through asteroseismology about planetary systems, and show how some are similar to Earth, while other exoplanets have no counterpart in our own solar system. Finally, I talk about the many exciting open questions which remain, and how upcoming instruments and space missions may provide some answers over the next decade. All of this will bring us closer to answering the fundamental question: are we alone?

PROGRAMME

Crafoord *Days* 2024

Overview programme Crafoord *Days* 2024

Monday 13 May | LUX, HELGONAVÄGEN 3, LUND — 09:30

THE CRAFOORD PRIZE LECTURE IN **MATHEMATICS**
Held by the Crafoord Laureate **Claire Voisin**.

THE CRAFOORD PRIZE LECTURES IN **ASTRONOMY**

Held by the Crafoord Laureates **Douglas Gough**, **Jørgen Christensen- Dalsgaard** and **Conny Aerts**.

Wednesday 15 May

09:30 CRAFOORD PRIZE SYMPOSIUM IN **MATHEMATICS**

Algebraic geometry and Kähler geometry

Lecture by the Crafoord Laureate **Claire Voisin** and invited speakers.

KTH ROYAL INSTITUTE OF TECHNOLOGY, LINDSTEDTSVÄGEN 3, STOCKHOLM

09:00 CRAFOORD PRIZE SYMPOSIUM IN **ASTRONOMY**

New avenues in solar and stellar physics

Lectures by the Crafoord Laureates **Douglas Gough**, **Jørgen Christensen-Dalsgaard**, **Conny Aerts** and invited speakers.

THE BEIJER HALL, THE ROYAL SWEDISH ACADEMY OF SCIENCES, LILLA FRESCATIVÄGEN 4A, STOCKHOLM

Registration at www.kva.se

Thursday 16 May | THE BEIJER HALL, THE ROYAL SWEDISH ACADEMY OF SCIENCES, LILLA FRESCATIVÄGEN 4A, STOCKHOLM — 16:30

THE CRAFOORD PRIZE AWARD CEREMONY

In the presence of **HRH The Crown Princess**.

By invitation only.

Detailed programme

The Crafoord *Prize* Lectures in Mathematics and Astronomy

LUX,
HELGONAVÄGEN 3,
LUND

Monday 13 May

Seating is limited. For registration and further information visit:
www.kva.se/crafoordprizelectures2024

09:30	Presentation of the Crafoord *Prize*	Sofia Feltzing, Chair of the Crafoord Prize Committee in Astronomy
09:35	Introduction of the Crafoord Laureate in Mathematics 2024	Nils Dencker, Member of the Crafoord Prize Committee in Mathematics
09:45	*From complex numbers to hyper-Kähler geometry*	CRAFOORD LAUREATE Claire Voisin, Institut de Mathématiques de Jussieu, France
10:20	Questions from the audience	CHAIR: Nils Dencker, Member of the Crafoord Prize Committee in Mathematics
10:30	COFFEE BREAK	
10:50	Introduction of the Crafoord Laureates in Astronomy 2024	Dainis Dravins, Member of the Royal Swedish Academy of Sciences
11:00	*Probing inside the Sun*	CRAFOORD LAUREATE Douglas Gough, University of Cambridge, UK
11:35	Questions from the audience	CHAIR: Sofia Feltzing, Chair of the Crafoord Prize Committee in Astronomy
11:45	LUNCH	(Lunch is served outside the lecture hall and is included for registered participants.)
13:00	*From the Sun to solar-like stars*	CRAFOORD LAUREATE Jørgen Christensen-Dalsgaard, Aarhus University, Denmark
13:35	Questions from the audience	CHAIR: Sofia Feltzing, Chair of the Crafoord Prize Committee in Astronomy
13:45	*Beyond sun-like stars*	CRAFOORD LAUREATE Conny Aerts, KU Leuven, Belgium
14:20	Questions from the audience	CHAIR: Sofia Feltzing, Chair of the Crafoord Prize Committee in Astronomy
14:30	Closing of the Crafoord Prize Lectures	Sofia Feltzing, Chair of the Crafoord Prize Committee in Astronomy

Detailed programme

THE CRAFOORD PRIZE SYMPOSIUM IN MATHEMATICS 2024

Algebraic geometry and Kähler geometry

KTH
ROYAL INSTITUTE
OF TECHNOLOGY,
LINDSTEDTSVÄGEN 3,
STOCKHOLM

Seating is limited. For registration and further information visit: www.kva.se/crafoordmathematics2024

Wednesday 15 April

	MORNING SESSION	CHAIR: **John Christian Ottem**, University of Oslo, Norway
09:30	Opening address	**Per Strömberg**, 2:nd Vice-President of the Royal Swedish Academy of Sciences
09:35	Presentation of the Crafoord Laureate	**David Rydh**, Member of the Crafoord Prize Committee in Mathematics
09:45	*On the smoothability of cycles in the Whitney range*	CRAFOORD LAUREATE **Claire Voisin**, Institut de Mathématiques de Jussieu, France
10:45	COFFEE BREAK	
11:15	*The algebra of symmetric tensors*	**Arnaud Beauville**, Université Côte d'Azur, France
12:15	LUNCH	(Included for registered participants)
	AFTERNOON SESSION	CHAIR: **Bo Berndtsson**, Member of the Crafoord Prize Committee in Mathematics
13:15	*Moduli spaces of twisted sheaves and applications*	**Daniel Huybrechts**. Universität Bonn, Germany
14:15	*Curves on powers of hyperelliptic Jacobians*	**Stefan Schreieder**, Leibniz Universität Hannover, Germany
15:15	COFFEE BREAK	
15:45	*Nonsmoothable cycles on algebraic varieties*	**Olivier Debarre**, Université Paris Cité, France
16:45	END OF SYMPOSIUM	

Detailed programme

THE CRAFOORD PRIZE SYMPOSIUM IN ASTRONOMY 2024

New avenues in solar and stellar physics

THE BEIJER HALL,
THE ROYAL SWEDISH
ACADEMY OF SCIENCES,
LILLA FRESCATIVÄGEN 4A,
STOCKHOLM

Seating is limited. For registration and further information visit: www.kva.se/crafoordastronomy2024

Wednesday 15 May

09:00	Opening address	Birgitta Henriques Normark, President of the Royal Swedish Academy of Sciences
09:05	Introduction of the Crafoord Laureates	Nikolai Piskunov, Member of the Crafoord Prize Committee in Astronomy
09:15	*Listening to the Stars*	
	PART I: *Physics from the Sun*	CRAFOORD LAUREATE Douglas Gough, University of Cambridge, UK
	PART II: *Asteroseismology of evolved solar-like stars*	CRAFOORD LAUREATE Jørgen Christensen-Dalsgaard, Aarhus University, Denmark
	PART III: *Asteroseismology of fast rotators*	CRAFOORD LAUREATE Conny Aerts, KU Leuven, Belgium
10:30	COFFEE BREAK	
11:00	*Helioseismology with inertial modes*	Laurent Gizon, Max Planck Institute for Solar System Research and University of Göttingen, Germany
11:30	*A high-resolution view of solar oscillations and waves*	Jaime de la Cruz Rodriguez, Stockholm University, Sweden
12:00	LUNCH	(Included for registered participants)
13:00	*Internal structures of low-mass stars*	Saskia Hekker, Heidelberg Institute for Theoretical Studies, Germany
13:30	*Intermediate-mass stars as physics laboratories*	Margarida Cunha, Universidade do Porto, Portugal
14:00	*The evolution of massive stars, single and binary*	Hugues Sana, KU Leuven, Belgium
14:30	*Insights into the interiors of massive stars*	Georges Meynet, Geneva University, Switzerland
15:00	COFFEE BREAK	
15:30	*Understanding exoplanets through asteroseismology*	Vincent Van Eylen, University College London, UK
16:00	*The importance of asteroseismology in the study of the Milky Way as a galaxy*	Andrea Miglio, Università di Bologna, Italy
16:30	SHORT BREAK	
16:35	Panel discussion	
17:05	Closing remarks	

Anna-Greta and Holger Crafoord

HOLGER AND ANNA-GRETA 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.

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 Lund University.

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 Lund University.

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 was founded in 1739 and is an independent non-governmental organisation, whose overall objective is to promote the sciences and strengthen their influence in society. The Academy has a particular responsibility for natural science and mathematics, but its work strives to increase interaction between different disciplines. The activities of the Royal Swedish Academy of Sciences primarily focus on:

- being a voice of science in society and influencing research policy (policy for science)
- providing a scientific basis for public debate and decision-making (science for policy)
- recognizing outstanding contributions to research
- being a meeting place for science, within and across subject boundaries
- providing support for young researchers
- stimulating interest in mathematics and natural science in school
- disseminating knowledge to the public
- mediating international scientific contacts
- preserving scientific heritage

THE ACADEMY has around 480 Swedish and 175 foreign members who are active in classes, committees and working groups. They initiate enquiries, consultation documents, conferences and seminars. The Academy has General Meetings a number of times each year.

THE ACADEMY´S institutes offer unique research environments in ecological economics, botany, the history of science and mathematics.

Every year, the Academy awards a number of prizes and rewards. The best known are the Nobel Prizes in Physics and Chemistry and the Sveriges Riksbank Prize in Economic Science in Memory of Alfred Nobel (the Prize in Economic Sciences). Other major prizes are the Crafoord Prize, Sjöberg Prize, Göran Gustafsson Prizes, Söderberg Prize and the Tobias Prize. The Göran Gustafsson Prizes are awarded to outstanding young researchers and are a combination of a personal prize and research funding. Since 2012, the Academy of Sciences has been one of the academies involved in implementing the Wallenberg Academy Fellows career programme, which provide long-term funding to the most promising young researchers. As well as a comprehensive range of scholarships, the Academy is also involved in appointments to research posts in a number of programmes funded by external foundations.

Through its working groups and committees, the Academy also works to promote sustainable, science-based societal development in the area of energy and the environment, among others. Issues relating to education and conditions for teachers are another major interest. The Academy regularly organises lectures and workshops on various scientific topics for teachers and students. In the 1990s, the Academy and the Royal Swedish Academy of Engineering Sciences founded one of Sweden's biggest school development programmes, NTA – Naturvetenskap och teknik för alla (Science and Technology for all).

THE CRAFOORD PRIZE IS AWARDED IN PARTNERSHIP BETWEEN THE ROYAL SWEDISH ACADEMY OF SCIENCES AND THE CRAFOORD FOUNDATION IN LUND. THE ACADEMY IS RESPONSIBLE FOR SELECTING THE CRAFOORD LAUREATES.

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