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KUNGL. VETENSKAPS-AKADEMIEN
THE ROYAL SWEDISH ACADEMY OF SCIENCES

KVA-JSPS Seminar: New Windows to the Universe

Date: 26 November 2018

Venue: The Beijer Hall, The Royal Swedish Academy of Sciences, Lilla Frescativägen 4A, Stockholm

Organisers:
The Royal Swedish Academy of Sciences
The Japan Society for the Promotion of Science Stockholm Office
The Embassy of Japan in Sweden

150 SWEDEN-JAPAN 日本 スウェーデン 2018

The symposium will report on new findings in neutrino research and research on the newly detected gravitational waves.

Programme:

13.00 Welcome address
Professor Dan Larhammar, President of The Royal Swedish Academy of Sciences
Ambassador Shigeyuki Hiroki, The Embassy of Japan in Sweden
Dr. Yasuhiro Iye, Executive Director of The Japan Society for the Promotion of Science
Professor Christina Moberg, The Royal Swedish Academy of Sciences

13.15 New Windows to the Universe - a view onto the dark side of the Cosmos
Professor Hitoshi Murayama, University of California, Berkeley, and The University of Tokyo

14.10 Short break

14.15 Hunt for dark matter - direct and indirect experiments
Professor Jan Conrad, Stockholm University

14.35 Hunt for dark matter at the LHC
Dr Caterina Doglioni, Lund University

14.55 Coffee break

15.20 Neutrino and gravitational wave research in Kamioka
Professor Takaaki Kajita, The University of Tokyo

16.15 Short break

16.20 Prospects for LISA, the next generation gravitational-wave space observatory
Dr Ross Church, Lund University

16.40 Neutrino astronomy with IceCube
Dr Erin O'Sullivan, Stockholm University

17.00 Panel conversation

17.50 Closing

The symposium is free of charge and open to the public but registration is required for all participants. For registration please visit: www.kva.se/newwindowstotheuniverse

The symposium is sponsored by the Royal Swedish Academy of Sciences through the Nobel Institute for Physics, Stiftelsen Till Bröderna Jacob och Marcus Wallenbergs minne, and the Japan Society for the Promotion of Science

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KVA-JSPS Seminar: New Windows to the Universe

Abstracts

Neutrino and gravitational wave research in Kamioka

Professor Takaaki Kajita, The University of Tokyo

Professor Takaaki Kajita

More than 30 years ago, Kamiokande experiment began in Kamioka. It observed Supernova neutrinos, atmospheric neutrino deficit, and solar neutrinos. Because of the importance of the studies of these neutrinos, Super-Kamiokande was constructed. It began the experiment in 1996. In 1998, neutrino oscillation was discovered with the studies of atmospheric neutrinos. In Kamioka, a new large-scale project is under construction. It is an experiment to study gravitational wave, which is called KAGRA. In this lecture, I will discuss the past, present and future of the researches in Kamioka.

Takaaki Kajita is the Special University Professor at the University of Tokyo, and also the Director of the Institute for Cosmic Ray Research (ICRR) of the University of Tokyo. Kajita received his Ph.D. from the University of Tokyo, School of Science in 1986, and has been researching at Kamiokande and Super-Kamiokande detectors at the Kamioka Observatory in central Japan. In 1998, at the Neutrino International Conference held in Takayama, Gifu, he showed the analysis results which provided strong evidence for atmospheric neutrino oscillations. In 2015, he shared the Nobel Prize in Physics for his role in discovering atmospheric neutrino oscillations. Currently, he is the project leader for KAGRA Project, aiming to explore the gravitational wave astronomy.

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New Windows to the Universe - a view onto the dark side of the Cosmos

Professor Hitoshi Murayama, University of California, Berkeley, and
The University of Tokyo

Professor Hitoshi Murayama

Where do we come from? Why do we exist? Recently, we discovered clues to these age-long questions. Most of matter in the Universe today is dark matter, our mother that let births to stars and galaxies and us, by nurturing and raising the seeds planted by cosmic inflation, our father that stretched a tiny Universe smaller than an atom to the big Universe we see today. We also need superheroes who protected us from a complete annihilation. While inflation led to an equal number of matter and anti-matter, neutrinos may well have turned a billionth of anti-matter into matter so that we could survive. We need new windows to the Universe into the dark side to understand this all.

Hitoshi Murayama is MacAdams Professor of Physics at the University of California, Berkeley and a Principal Investigator at the Kavli Institute for the Physics and Mathematics of the Universe at the University of Tokyo which he led for 11 years as the founding Director. He is a recipient of Yukawa Commemoration Prize, Humboldt Research Award, and a Fellow of American Physical Society.

Prospects for LISA, the next generation gravitational-wave space observatory

Dr Ross Church, Lund University

Photo: David Simner

LISA is a space-based gravitational wave interferometer under development for projected launch by ESA in 2034. With an arm length of millions of kilometers, LISA will be able to detect much lower frequency gravitational waves than ground-based detectors such as LIGO. This opens a window onto a range of astrophysical phenomena, many of which cannot currently be probed directly. For example, LISA will detect the merger of massive black holes as far back as the cosmic dark ages, identify extreme mass ratio inspirals in galactic nuclei, and make a survey of compact binaries in the Milky Way. I will give an overview of LISA sources and the science that they will yield.

Ross Church (PhD 2007, Cambridge University) is a senior lecturer at Lund University, specialising in the structure and evolution of stars and stellar systems. His current particular interests are in spectroscopic surveys and in binary stars as progenitors for explosive transients and gravitational wave sources. He is the Swedish representative on the LISA consortium board.

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Hunt for dark matter - direct and indirect experiments

Professor Jan Conrad, Stockholm University

Photo: Eva Dalin

The nature of dark matter is one of the most intriguing problems of modern physics. The most compelling hypothesis supported by ample evidence is that dark matter is made of still unknown new type(s) of particles. Direct and indirect searches for dark matter aim at detecting dark matter particles by searching for signals from extraterrestrial sources. Japanese and Swedish scientists collaborate on the most sensitive instruments used in this endeavor. I will discuss the approaches, describe these instruments and briefly point out future directions.

Jan Conrad is professor in astroparticle physics at Stockholm University. He did his PhD in 2003 at Uppsala University. After returning from a postdoctoral fellowship at CERN, he started working on astrophysical detection of dark matter mainly with space-borne and Earth-based gamma-ray telescopes. In 2015, Conrad joined the XENON experimental programme aimed at detecting dark matter in deep underground experiments.

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Hunt for dark matter at the LHC

Dr Caterina Doglioni, Lund University

Photo: Lena Björk Blixt.

Particle colliders have revealed much about the nature and composition of ordinary matter. Can they help solve the mystery of dark matter? This talk will describe how experiments at the Large Hadron Collider at CERN and new experiments using particle accelerators are searching for signs of dark matter particles and how it interacted with ordinary matter in the early universe, in synergy with direct and indirect detection experiments.

Caterina Doglioni is an associate senior lecturer at Lund University. Her main topic of research is dark matter at the Large Hadron Collider and new experiments at particle accelerators, with a focus on novel data taking techniques. She received her Master's degree at Universita' Sapienza (Rome) and her PhD at the University of Oxford. Her research is supported by an ERC Starting Grant (DARKJETS) and by the Swedish Research Council.

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Neutrino astronomy with IceCube

Dr Erin O'Sullivan, Stockholm University

Photo: Serena Nobili

The neutrino is a neutral, nearly-massless particle that was first discovered almost 60 years ago. Since then, technological advancements have made it possible to use neutrinos as probes of extreme astrophysical environments. IceCube is a neutrino telescope that the uses the ice at the South Pole to detect high energy neutrinos originating from outside of our galaxy. IceCube recently identified, for the first time, a likely source of high energy astrophysical neutrinos - a blazar. This breakthrough ushers in a new era of neutrino astronomy and opens the door to further understanding the most powerful particle accelerators found in Nature.

Erin O'Sullivan was born in Toronto, Canada. After obtaining her PhD in 2014 from Queen's University in Canada, she moved to Duke University in the USA, where she worked on two Japanese neutrino experiments: Super-Kamiokande and Hyper-Kamiokande. She has been at Stockholm University as a postdoctoral researcher since 2017, where she studies astrophysical neutrinos as a collaborator on the IceCube and Hyper-Kamiokande experiments.