

Title: Particles & Cosmos

Abstract:

Earth-based experiments and space-based telescopes advance our understanding of the so far secret mechanism of the Universe at the tiniest scale, of what matter was like in the first moments of the Universe's life. Furthermore, they have given us new insights into the mysterious world of dark matter and dark energy as well as of black holes and quantum gravity. The experimental findings kicked off a real revolution of the mind, changing our view of the Universe.

This session will discuss recent results from forefront particle experiments, black hole and inflation physics, and theoretical developments in cosmology.

Conveners: Andre Mischke and Stefan Vandoren

Speakers (in order of appearance)

Stan Bentvelsen (Nikhef)

Title: From CERN collider physics to the Einstein Telescope - physics beyond the Standard Model of particle physics

Abstract: With the LHC at CERN in full swing, it is harvest time for particle physics. With so many collisions, the LHC provides excellent opportunity to search for physics beyond the Standard Model. Searching for new particles are ongoing that may correspond to the Dark Matter of our Universe. Detailed study of the Higgs particle and subtle quantum effects have the potential to reveal new physics as well. Nikhef is optimized to perform this scientific program.

Gravity Waves provide a novel approach to unlock the fundament of space and time. After the successful first run of Virgo, Nikhef will continue to play a large role in the next generation of interferometers and prepares a bid to host the Einstein Telescope in the Netherlands.

Dorothea Samtleben (Leiden University)

Title: Neutrinos from the cosmos

Abstract: Neutrinos are arguably the least understood elementary particles. They are notoriously hard to detect, but offer a rich potential to provide new insights into the Universe and its fundamental content. Having no charge, being almost massless and interacting only weakly the neutrinos can transverse huge distances, undisturbed by magnetic fields or matter in the way and in this way serve as unique messengers from far depths of the Universe. With the first detection of high energetic cosmic neutrinos only a few years ago a new window to the Universe has been opened. The large neutrino telescopes built for the detection of cosmic neutrinos also allow for studies of the neutrinos themselves at unprecedented precision, promising new insights in the Standard Model of Particle Physics and potentially new physics. The Netherlands play a leading role in the KM3NeT observatory, which is currently under construction in the Mediterranean Sea. The status of this facility and its scientific potential in the hunt and harvest of cosmic neutrinos will be presented.

Ana Achúcarro (Leiden University)

Title: What drives inflation?

In memoriam Stephen Hawking (8-1-1942 | 14-3-2018)

Abstract: A grand challenge in cosmology is how to connect the large scale features in the distribution of matter and galaxies in the universe to the microscopic physics that seeded those structures around the time of the big bang. Hawking was among the first to realize, in the early eighties, that a burst of accelerated expansion of space ("cosmic inflation") would produce primordial density fluctuations with the right properties. But what causes the acceleration? I will discuss what we think we know about the nature of the field or fields driving inflation, including some recent surprises.

Heino Falcke (Radboud Universiteit Nijmegen)

Title: Imaging Black Holes now and in the future

Abstract: Imaging Black Holes now and in the future Heino Falcke, Radboud University Nijmegen One of the most fundamental predictions of general relativity are black holes. Their defining feature is the event horizon, the surface that even light cannot escape. So far, we have never seen the event horizon, but this is about to change. Advanced computer simulations make clear predictions of how the shadow of black holes should look like and global interferometric radio observations with the Event Horizon Telescope are now trying to image the supermassive black hole in the center of our own Milky Way and the radio galaxy M87 for the very first time. To improve the imaging quality further more telescopes should be added to the array, in particular in Africa. The more distant future will belong to higher frequencies and space-based interferometry. The talk will give an overview of the ongoing research to image and simulate black holes, as well as of plans for future expansions.