PHYSICS AND ASTRONOMY

CAP LECTURE

Dr. Claudio Kopper

University of Alberta

"Chasing Neutrinos in Antarctica"

Abstract

The IceCube Neutrino Observatory is a particle detector built into a cubic kilometre of natural Antarctic glacier, located deep beneath the South Pole — one of the planet's most extreme environments. Neutrinos, which interact very rarely in nature, represent an ideal messenger with their ability to travel from their point of production to detection almost entirely unimpeded. The IceCube observatory has a vast scientific program including searching for neutrinos from the most violent astrophysical processes such as Gamma Ray Bursts, Black Hole collapses and Active Galactic Nuclei as well as looking for signals from possible dark matter sources like the galactic center. It is also a powerful tool to study the properties of the neutrino itself. IceCube has recently discovered a flux of high-energy neutrinos of extra-terrestrial origin - pushing the field of neutrino-astronomy into a new era. The highest energy neutrinos observed by IceCube to date exceed 1 PeV in energy — the highest-energy neutrinos ever observed. This is a regime of particular interest because neutrinos should point back to the still elusive accelerators of the highest energy Galactic and extragalactic cosmic rays. By looking for the origin of these neutrinos, IceCube will be able to help solve the 100 year old mystery of the origin of these cosmic rays - particles striking our planet from all directions, some of which have energies much higher than anything we can create in particle accelerators here on Earth. I will give an overview of the IceCube detector, its vast physics program and discuss recent results not only on high-energy neutrino searches, but also on studies looking at neutrino oscillations and at searches for Dark Matter. In addition, I will describe our plans for future extensions of the IceCube detector to higher and lower energies and how these will allow us to study the sources of astrophysical neutrinos even better. A low-energy extension called "PINGU" will make it possible to study the still unknown ordering of neutrino masses by looking at oscillation effects of neutrinos in matter while passing through Earth.

Wednesday, February 17, 2016
3:00 p.m.
Bob Wright Centre
A104