# T 1: Neutrinoastronomie I

Zeit: Montag 16:00–18:30 Raum: Philo-HS1

T 1.1 Mo 16:00 Philo-HS1

**Effects of Ice Properties on the Angular Reconstruction of Track-Like Events in IceCube** — •Gerrit Wrede for the IceCube-Collaboration — Friedrich-Alexander-Universität Erlangen-Nürnberg, ECAP

The IceCube neutrino observatory is searching for point sources in the astrophysical neutrino flux. Relativistic muons created by muon-neutrinos offer a good angular resolution and are thus an ideal channel for the detection of points sources. The accurate reconstruction of the direction of the muons depends on a good understanding of the Antarctic ice. In this talk, a study on the systematic uncertainty of the angular resolution due to inaccurate ice-modelling is presented for different reconstruction scenarios.

T 1.2 Mo 16:15 Philo-HS1

**Improving the Reconstruction of Uncontained Events in IceCube** — Christian Haack and •Christopher Wiebusch — III. Physikalisches Institut B, RWTH Aachen University

The IceCube Neutrino Observatory has measured the astrophysical neutrino flux from a few 10TeV to a few PeV using multiple detection channels. However, two unsolved questions require larger statistics at PeV energies, namely the existence of a high-energy cutoff and the Glashow resonance. So far, event selections involving cascade-like events induced by neutral-current or charged-current electron neutrino interactions, are limited to contained events, where the interaction vertex is located inside the detector volume. To increase the sensitivity of IceCube to higher energies, the restriction to contained events has to be mitigated, thus including also uncontained events in the neutrino samples. Due to their topology, these events are extremely difficult to reconstruct and to distinguish from the atmospheric muon background. In this talk we will present new reconstruction and background rejection techniques for uncontained events in IceCube.

T 1.3 Mo 16:30 Philo-HS1

**Improvements in the Simulation of High Energy Charged Leptons for IceCube** — •Jan Soedingrekso, Mario Dunsch, Alexander Sandrock, Thorben Menne, Mathis Börner, and Max Meier for the IceCube-Collaboration — TU Dortmund, Dortmund, Deutschland

IceCube is a cubic kilometer scaled neutrino telescope detecting the Cherenkov light of charged particles propagating through the detector. To improve the reconstruction of the measured events, the systematic uncertainties have to be reduced in the simulation chain. PROPOSAL is a part of the IceCube simulation chain propagating charged leptons. This talk deals with recent improvements in PROPOSAL which can be separated into two topics: On the one hand physical aspects were enhanced to increase the precision of the propagation and reduce the systematic uncertainties. On the other hand programming aspects were improved to increase the performance and simplify usage and maintenance.

T 1.4 Mo 16:45 Philo-HS1

**Improving the muon track reconstruction of IceCube and IceCube-Gen2** — •Federica Bradascio for the IceCube-Collaboration — DESY Zeuthen

IceCube is a cubic-kilometer Cherenkov telescope operating at the South Pole. It aims at detecting astrophysical neutrinos and identifying their sources. High-energy muon neutrinos are identified by the secondary muons produced in the interactions with the ice. The muon tracks are reconstructed using a maximum likelihood method, which models the arrival times of Cherenkov photons registered by the photomultipliers. This work aims at improving the muon angular resolution of IceCube and of its planned extension, IceCube-Gen2, in the sub-degree range. The current muon reconstruction assumes continuous energy loss along the muon track, and does not take into account photomultiplier related effects like pre-pulses and after-pulses. In the reconstruction scheme presented here, the expected arrival time distribution has been modified in order to parametrize the effect of pre-pulses and the stochastic muon energy losses.

T 1.5 Mo 17:00 Philo-HS1

**Muon Veto Study Comparing pDOM and mDOM for IceCube-Gen2** — •Julian Saffer for the IceCube-Gen2-Collaboration — ECAP, Erlangen, Deutschland

IceCube is a large neutrino detector located at the geographic South Pole. An important part in many neutrino analyses for background reduction is the vetoing of atmospheric muons. For the currently planned IceCube extension, IceCube-Gen2, various detector geometries and Digital Optical Module (DOM) designs have been proposed. This talk presents a study in which two DOMs, the pDOM and mDOM, are compared in terms of their veto potential for atmospheric muons using the current baseline geometry for IceCube-Gen2.

T 1.6 Mo 17:15 Philo-HS1

**Resolving muon flux components in KM3NeT/ARCA** — •Tim Stüven for the ANTARES-KM3NeT-Erlangen-Collaboration — Friedrich-Alexander-Universität Erlangen-Nürnberg, ECAP

KM3NeT is an extensive research infrastructure in the Mediterranean deep sea which is currently under construction. KM3NeT/ARCA is the instrument part dedicated to high-energy neutrino astronomy at the KM3NeT Italy site off the coast of Sicily. The major goal of ARCA will be to study the origin of the high-energy astrophysical flux detected by IceCube.

The vast majority of events detected by ARCA will be down-going muons from the interactions of cosmic rays in the Earth's atmosphere. In addition, the conventional and prompt atmospheric neutrino flux, as well as the astrophysical flux, will generate incoming muons from all directions, with different energy dependencies. Studies aiming to e.g. identify the flavour composition of the astrophysical flux, or the magnitude of the prompt contribution, will need to simultaneously fit all these contributions. This talk will present the results of simulations of the muon flux expected at ARCA and discuss in which regimes of energy and direction different contributions – especially those of the conventional and prompt atmospheric flux – may be disentangled.

T 1.7 Mo 17:30 Philo-HS1

**Strings for absorption length in water** — Michael Böhmer, Christian Fruck, •Andreas Gärtner, Roman Gernhäuser, Felix Henningsen, Simon Hiller, Kilian Holzapfel, Klaus Leismüller, Laszlo Papp, Immacolata Rea, and Christian Spannfellner — Technische Universität München

Large scale neutrino telescopes such as IceCube, Antares and GVD have shown their scientific potential on numerous occasions in the past. Due to their size of up to cubic kilometers and their location deep below the surface of water or ice, any new installation poses a large challenge on materials and infrastructure. Ocean Networks Canada potentially provides the necessary infrastructure for numerous scientific experiments at the seabed of the Cascadia Basin off the coast of Vancouver Island. The "Strings for absorption length in water" (STRAW) project will deploy two 140m strings with optical pulsers and sensors for measuring the relevant water properties (absorption, scattering, radioactivity and bioluminescence) for a large scale detector at this site and assessing its feasibility. This talk will give a brief overview of the site and the general concept of the STRAW project.

T 1.8 Mo 17:45 Philo-HS1

**Strings for absorption length in water - Optical instruments** — Michael Böhmer, Christian Fruck, Andreas Gärtner, Roman Gernhäuser, Felix Henningsen, Simon Hiller, Kilian Holzapfel, Klaus Leismüller, Laszlo Papp, Immacolata Rea, and •Christian Spannfellner — Technische Universität München

The "Strings for absorption length in water" (STRAW) project aims to assess the feasibility and optical conditions for a possible future large scale neutrino detector off the shore of Vancouver Island. To investigate the feasibility of a future neutrino telescope, two test strings with optical modules will be deployed with the support of Ocean Networks Canada, an institution of the University of Victoria. The light source for the intended absorption and scattering measurement will be the Precision Optical Calibration Module (POCAM) isotropic nanosecond pulsers developed for IceCube-Gen2, successfully tested last year at the Baikal Gigaton Volume Detector. The light sensor sDOM containing photomultiplier tubes will measure the background luminescence and detect the attenuated POCAM flashes to monitor the water properties over the course of two years. This talk will summarize the optical instruments planned for deployment in June 2018.

T 1.9 Mo 18:00 Philo-HS1

**Data-driven approach for hadronic interactions in the estimation of atmospheric lepton fluxes** — •Matthias Huber[1] and Anatoli Fedynitch[2] — [1]Technische Universität München, Physik-Department, James-Franck-Str. 1, 85748 Garching — [2]DESY, Platanenallee 6, 15738 Zeuthen

Precise knowledge of atmospheric neutrino and muon fluxes is essential in the search for astrophysical neutrinos and the measurements of neutrino oscillations. Atmospheric leptons are created in extensive air shower cascades initialized by cosmic rays (CRs) entering the Earth's atmosphere. The evolution of an atmospheric particle shower can be described by cascade equations, which characterize the transport and conversion of various particle species through the atmosphere. The Matrix Cascade Equations (MCEq) software is using this approach in a semi-analytical way to estimate the flux of atmospheric particles at the surface of Earth. The precision of these leptonic fluxes is mainly limited by the uncertainties in the CR spectrum and the lack of knowledge from hadronic particle interactions within the cascade. For the latter input from Monte Carlo event generators (SIBYLL or EPOS) is integrated in the current version of MCEq. Over the last years, fixed target experiments at CERN operated high precision measurements to study the behavior of such hadronic particle interactions. In this talk a method to incorporate these experimental results to the MCEq framework and the potential of this approach to reduce the uncertainties of atmospheric lepton fluxes are presented.

T 1.10 Mo 18:15 Philo-HS1

**Radiative corrections to the energy loss of high-energy muons** — Alexander Sandrock, •Thorben Menne, and Jan Soedingrekso — TU Dortmund

High-energy muons can travel large thicknesses of matter. For underground neutrino and cosmic ray detectors the energy loss of muons has to be known accurately for simulations. The processes through which muons loose energy are ionization, direct pair production, bremsstrahlung and inelastic nuclear interaction. Next-to-leading order corrections to the bremsstrahlung energy loss are presented.