T 41: Neutrinoastronomie

Zeit: Montag 16:45–19:00 Raum: VMP9 SR 30

T 41.1 Mo 16:45 VMP9 SR 30

Analysis of Electron-Neutrino induced Cascades in IceCube — •Eike Otto for the IceCube-Collaboration — TU Dortmund, Dortmund, Deutschland

IceCube is a neutrino observatory located at the South Pole. It is capable of detecting neutrinos over a large energy range. The search for astrophysical neutrinos faces the challenges of a very low signal-to-background ratio due to the large amount of atmospheric muons.

Electron neutrinos that interact with nuclei in the surrounding ice produce secondary particles that create a unique spherical pattern called 'cascade' which can be detected with the IceCube detector.

This work concentrates on the analysis of electron neutrino induced cascades in IceCube using multivariate methods. The event selection puts focus on selecting neutrino candidates from the atmospheric and muon background. The overall analysis goal is an estimation of the electron neutrino energy spectrum.

In this talk I will present the current state of my analysis and give a perspective on following steps.

T 41.2 Mo 17:00 VMP9 SR 30

Calculation of the Cherenkov Light Yield of High-Energetic Particle Cascades in IceCube — •Ömer Penek, Leif Rädel, and Christopher Wiebusch for the IceCube-Collaboration — III. Physikalisches Institut, RWTH Aachen University, D-52056 Aachen, Germany

Cherenkov light occurs if a charged particle in a dielectric moves faster than the phase velocity of light. The radiation emitted by a single track per unit path length and unit frequency of light is given by the well-known Frank-Tamm formula. This formula assumes single particle tracks that are much longer than the emitted wavelength and the size of the polarization region. We will present a first principle calculation of the Cherenkov light yield which is applicable for the case of very high particle densities where the polarization regions of the tracks may overlap. This can be relevant for the recently observed ultra-high-energetic neutrino interactions in IceCube.

T 41.3 Mo 17:15 VMP9 SR 30

Higher order corrections to muon cross sections — •Alexander Sandrock for the IceCube-Collaboration — Technische Universität Dortmund

The energy reconstruction of high-energetic muons in the IceCube neutrino observatory is based on the energy losses through electromagnetic interactions. The systematic uncertainties of IceCube are among others the result of uncertainties in the muon cross-sections for bremsstrahlung, pair production and photonuclear interaction. This presentation will give a brief overview about the status of currently used parametrizations and a new calculation for the bremsstrahlung cross section that also takes into account higher order corrections.

T 41.4 Mo 17:30 VMP9 SR 30

Search for Indications of the Neutrino Mass Hierarchy Using IceCube/DeepCore — •Martin Leuermann, Markus Vehring, Marius Wallraff, and Christopher Wiebusch for the IceCube-Collaboration — III. Physikalisches Institut B, RWTH Aachen, Germany

In 2015, the Nobel prize in physics was awarded for "the discovery of neutrino oscillations, which shows that neutrinos have mass", showing the high relevance of neutrino masses for modern particle physics. However, the ordering of the three neutrino masses is still unknown and is often referred to as neutrino mass hierarchy. Its measurement is a major goal for future experiments. One strategy is to measure matter effects in the oscillation pattern of atmospheric neutrinos e.g. as proposed for the PINGU extension of the IceCube neutrino observatory. Already now, the IceCube/DeepCore detector at the Geographic South Pole can be used to search for this signature. In this talk, we present an analysis based on data taken between 2011 and 2015. Due to recent improvements in the detector's reconstruction performance and the quality of the data selection, a measurement on the significance level of 1 sigma is expected.

T 41.5 Mo 17:45 VMP9 SR 30

Search for neutrino emission from the Galactic plane with IceCube using starting events — •Kai Krings for the IceCube-Collaboration — TU München, Physik-Department, Excellence Cluster Universe, Boltzmannstr. 2, 85748 Garching

The IceCube Neutrino Telescope has observed a diffuse all-sky all-flavor astrophysical neutrino flux above 30 TeV; no sources have been identified yet. We want to challenge the question if the flux is partly of Galactic origin, searching for an integrated neutrino signal along the Galactic plane. Complementary to the search with up-going muon neutrinos, which is constrained to the northern sky only, we use events from both hemispheres with energies above 1 TeV starting inside the IceCube detector. Thus, the entire Galactic plane can be observed, including the Galactic Center. We present the sensitivity of a likelihood-based analysis to generic Galactic plane models, using two years of starting event data.

T 41.6 Mo 18:00 VMP9 SR 30

Korrekturen an Paarproduktions-Wirkungsquerschnitten für Neutrinosimulationen bei IceCube — •Jan Soedingrekso für die IceCube-Kollaboration — TU Dortmund, Dortmund, Deutschland

Ein Ziel des Neutrinoteleskops IceCube ist die Energiebestimmung der den Detektor durchlaufenden Leptonen. Die Rekonstruktion dieser Energie basiert auf Monte Carlo Simulationen. Für geringere systematische Unsicherheiten bei experimentell beobachteten Ereignissen und somit genauere Vorhersagen, müssen in der Simulation die Wechselwirkungen der Teilchen mit der Materie möglichst genau berechnet sein. Dabei tragen bei hohen Energien hauptsächlich die Bremsstrahlung, Paarproduktion und photonukleare Wechselwirkung zum Energieverlust bei.

In dem Vortrag wird ein Überblick über den aktuell im Leptonpropagator PROPOSAL verwendeten Wirkungsquerschnitt der Paarproduktion gegeben, sowie weitere Einflüsse und Korrekturterme vorgestellt.

T 41.7 Mo 18:15 VMP9 SR 30

Rekonstruktion der Myon-Energie am IceCube-Neutrinodetektor durch k-NN-Regression — •Mirco Hünnefeld für die IceCube-Kollaboration — TU Dortmund, Dortmund, Deutschland

Die Energierekonstruktion von Myonen stellt eine zentrale Herausforderung am IceCube-Neutrinodetektor dar. Bisherige Implementationen nutzen die Spurlänge bei niederenergetischen und bei höherenergetischen Myonen den myonspezifischen Energieverlust dE/dx, um die Energie zu bestimmen.

Deutliche Performance-Steigerungen sind durch die Verwendung maschineller Lernverfahren möglich. Als Beispiel wird die k-NN-Regression zur Energierekonstruktion von Myonen vorgestellt und mit den bestehenden Rekonstruktionsmethoden verglichen.

Die vorgestellte Methodik ist zudem analog auf andere Probleme anwendbar, wie zum Beispiel die Spurrekonstruktion von Elektron-Neutrinos am IceCube-Neutrinodetektor.

T 41.8 Mo 18:30 VMP9 SR 30

Luminescence as a new detection method for non-relativistic highly ionizing particles in water/ice neutrino telescopes — •Anna Pollmann for the IceCube-Collaboration — Bergische Universität Wuppertal

Cosmic ray detectors use air as a radiator for luminescence. In water and ice detectors Cherenkov light is the dominant light producing mechanism when the particle velocity exceeds the Cherenkov threshold, approximately three quarters of the speed of light.

Luminescence is produced by highly ionizing particles passing through matter due to the excitation of the surrounding atoms. The observables of luminescence, such as the wavelength spectrum and decay times, are highly dependent on the properties of the medium. Therefore, the results of measurements, in which luminescence was produced by particles passing through water or ice, vary by two orders of magnitude in intensity.

It will be shown that, even for the most conservative intensity value, luminescence can be used as a detection method for highly ionizing particles with velocities below the Cherenkov threshold. These could be magnetic monopoles or other massive and highly penetrating exotic particles. In the most optimistic case, luminescence contributes even to the light output of standard model particles.

T 41.9 Mo 18:45 VMP9 SR 30

Search for neutrinos from flaring blazars — •Michael Kreter[1,2], Thomas Eberl[2], Clancy James[2], and Matthias Kadler[1] for the ANTARES-KM3NeT-Erlangen-Collaboration — [1]Lehrstuhl für Astronomie, Universität Würzburg, Emil-Fischer-Strasse 31, 97074 Würzburg, Germany — [2]ECAP, Universität Erlangen-Nürnberg, Erwin-Rommel-Str. 1, 91058 Erlangen, Germany

Jets from Active Galactic Nuclei (AGN) are among the best candidates for the recently detected extraterrestrial neutrino flux. Hadronic AGN jet-emission models predict a tight correlation between the neutrino flux and the time-variable gamma-ray emission. At the same time, the atmospheric-background (noise) signal, which often dominates in neutrino-astronomical observations, can be substantially reduced by rejecting long-lasting periods of low flux. For these reasons, short high-amplitude gamma-ray flares, as often observed in blazars, can be used to substantially increase the sensitivity of neutrino telescopes in point-source searches. We develop a strategy to search for TeV neutrinos from flaring blazar jets from the TANAMI sample using the ANTARES telescope and Fermi gamma-ray light curves. An unbinned maximum-likelihood method is applied to optimize the probability of a neutrino detection from TANAMI sources.