T 96: Neutrinoastronomie III

Zeit: Donnerstag 16:45–19:15 Raum: I.12.02 (HS 31)

T 96.1 Do 16:45 I.12.02 (HS 31)

The Impact of the Ice Model on Tau Neutrino Reconstruction in IceCube — •Marcel Usner and Marek Kowalski for the IceCube-Collaboration — DESY Zeuthen

The IceCube Neutrino Observatory at the South Pole is a Cherenkov detector with an instrumented volume of about one cubic kilometer of the Antarctic ice. Tau neutrinos can be measured via the double bang signature that links two subsequent cascades from the neutrino interaction and the tau decay. Reconstruction of double bang events is currently limited to PeV energies and above where the decay length of the tau is greater than 50m. At lower energies it is important to consider small effects that affect the propagation of Cherenkov photons in the ice. The most recent model of the glacial ice below South pole contains a tilt of the ice layers and an anisotropy of the scattering coefficient in the direction of the glacier flow. These effects cannot be incorporated trivially into the existing reconstruction methods and can have a significant impact on single and double cascade reconstruction. Updates on finding a solution to this problem will be presented and the effect on the reconstruction of tau neutrino events will be discussed.

T 96.2 Do 17:00 I.12.02 (HS 31)

Strahlungskorrekturen an Myon-Bremsstrahlungs-Wirkungsquerschnitten — •Thorben Menne und Alexander Sandrock — Technische Universität Dortmund

In Simulationen für Astroteilchendetektoren wird unter anderem die Propagation der beteiligten Teilchen durch Materie betrachtet. Um genaue Vorhersagen zu erhalten, müssen die beteiligten Prozesse der Wechselwirkung der Teilchen mit der Materie auch von der theoretischen Seite so genau wie möglich bekannt sein. Bei hohen Energien entfällt der Hauptteil des Energieverlustes von Myonen in Materie auf Bremsstrahlung, photonukleare Wechselwirkung und Paarproduktion. Die momentan in Simulationen genutzten Wirkungsquerschnitte für Bremsstrahlung enthalten bereits viele Korrekturen wie zum Beispiel Abschirmungseffekte und die Berücksichtigung einer endlichen Kerngröße. Strahlungskorrekturen höherer Ordnung sind jedoch noch nicht untersucht worden. In diesem Vortrag wird ein Überblick über die momentan in Simulationen verwendeten Myon-Bremsstrahlungs-Wirkungsquerschnitte gegeben. Darüber hinaus wird ein Plan für die beabsichtigte Berechnung von Strahlungskorrekturen vorgestellt.

T 96.3 Do 17:15 I.12.02 (HS 31)

Performance study of track and energy reconstruction in IceCube — •Matthias Huber, Kevin Abraham, and Stefan Coenders for the IceCube-Collaboration — TU München, Physik-Department, Excellence Cluster Universe, Boltzmannstr. 2, 85748 Garching

The IceCube Neutrino Observatory is the World largest neutrino telescope located at the South Pole. It instruments one cubic kilometer of Antarctic ice with 5160 optical modules (DOMs) at a depth of about 1500 m to 2500 m.

IceCube found evidence for astrophysical neutrinos but still their sources remain hidden. Muons created in charged-current neutrino interactions give good reconstruction accuracy for the search of neutrino sources. Current analyses in IceCube, such as for instance the point source analysis, consist of several different methods to reconstruct the angular direction and resolution and the energy of track-like secondary muons.

This talk presents the performance of two different event reconstructions and an estimation of their uncertainties.

T 96.4 Do 17:30 I.12.02 (HS 31)

Moon and Sun Shadow Observation with IceCube — •Fabian Bos[1], Frederik Tenholt[1], Julia Becker-Tjus[1], and Stefan Westerhoff[2] for the IceCube-Collaboration — [1]Theoretische Physik, Ruhr-Universität, Bochum — [2]University of Wisconsin, Madison, USA

The analysis of the Moon shadow is a standard method in IceCube to determine the angular resolution and absolute pointing capabilities of the IceCube detector at the geographic South Pole. The Sun has not been used as a calibrator thus far, as its shadow is expected to be influenced by the solar magnetic field, which deflects the cosmic rays near the solar surface. This, on the other hand, provides indirect pieces of information on the magnetic field structure of the Sun. This talk shows a first analysis of the Sun shadow with IceCube data. The analysis is based on the data of the detector configurations with 79 (IC79) and 86 strings (IC86) from 2010 through 2012. To examine the shadows, a binned method is used to compare all events from one on-source with two off-source windows. For the IC40 and IC59 configuration a deficit with a statistical significance of more than 6σ was observed.

T 96.5 Do 17:45 I.12.02 (HS 31)

IceCube filters towards an unified all-flavor neutrino sample — •Kai Krings[1], Juliane van Scherpenberg[1], and Marcel Zoll[2] for the IceCube-Collaboration — [1]TU München, Physik-Department, Excellence Cluster Universe, Boltzmannstr. 2, 85748 Garching — [2]Oskar Klein Centre and Dept. of Physics, Stockholm University, SE-10691 Stockholm, Sweden

IceCube measured an astrophysical neutrino flux in the 100 TeV to PeV range at the level of $10^{-8}\,\mathrm{GeV cm^{-2} s^{-1} sr^{-1}}$ per flavor with three years of data collected between 2010 and 2012. The data is consistent with isotropic neutrino arrival directions. In order to enhance the probability to detect the sources of these neutrinos, the data sample can still be optimized by taking all possible detection channels into account and by optimizing various steps of the data processing chain. The goal is to create an unified all-flavor neutrino sample that selects both track- and cascade-like events originating from the whole sky. As a first step, we investigated a possible increase in the efficiency of selecting (neutrino-induced) muon events at the South Pole when introducing a new clustering algorithm earlier into the processing chain. This algorithm was developed to find and split coincident events and to remove hits caused by noise. The results of this study are going to be presented in this talk.

T 96.6 Do 18:00 I.12.02 (HS 31)

IceCube-Gen2 sensitivity improvement for steady neutrino point sources — •Stefan Coenders and Elisa Resconi for the IceCube-Collaboration — TU München, Physik-Department, Excellence Cluster Universe, Boltzmannstr. 2, 85748 Garching

The observation of an astrophysical neutrino flux by high-energy events starting in IceCube strengthens the search for sources of astrophysical neutrinos. Identification of these sources requires good pointing at high statistics, mainly using muons created by charged-current muon neutrino interactions going through the IceCube detector. We report about preliminary studies of a possible high-energy extension *IceCube-Gen2*. Using a 6 times bigger detection volume, effective area as well as reconstruction accuracy will improve with respect to IceCube. Moreover, using (in-ice) active veto techniques will significantly improve the performance for Southern hemisphere events, where possible local candidate neutrino sources are located.

T 96.7 Do 18:15 I.12.02 (HS 31)

A simulation study of possible detector geometries for the future IceCube extension IceCube-Gen2 — •Richard Konietz, Jacob Leuner, Jan Auffenberg, Christian Haack, and Christopher Wiebusch for the IceCube-Collaboration — 3. Physikalisches Institut B, RWTH Aachen

The discovery of high-energy neutrino sources would be a major breakthrough for astroparticle physics, as they are expected to be connected to the sources of cosmic rays. The IceCube Neutrino Observatory, a cubic-kilometer-sized neutrino telescope at the geographic South Pole, has discovered a diffuse neutrino flux. Even after four years of data taking no indication for point sources has been found. To significantly increase the chance of identifying sources of high-energy neutrinos, a larger detector is needed. We study possible geometries for the future IceCube extension IceCube-Gen2, which is planned to instrument a volume about an order of magnitude larger than IceCube. In this study, the geometry is optimised for a single connected detector with a maximised projected area and an optimal angular resolution.

T 96.8 Do 18:30 I.12.02 (HS 31)

Micro parallelism vs. macro parallelism - methods to speed up IceCube track and energy reconstructions — •Kevin Abraham for the IceCube-Collaboration — TU München, Physik-Department, Excellence Cluster Universe, Boltzmannstr. 2, 85748

Garching

The IceCube Neutrino Telescope located at the South Pole is the World's largest neutrino telescope. The sensitivity of IceCube to astrophysical point sources strongly depends on the accuracy of track reconstructions. Accurately reconstructing an event requires a large amount of computational resources. Specifically, significant time is spent evaluating spline tables. This talk reports on two different approaches to speed up spline table evaluations,by using GPUs and by utilizing the vector extensions available in the instruction set of modern CPUs. Additionally, the effect of machine precision on reconstruction accuracy is presented.

T 96.9 Do 18:45 I.12.02 (HS 31)

Das IceCube Echtzeit-System — •Alexander Johannes Stasik für die IceCube-Kollaboration — DESY Zeuthen, Platanenallee 6, 15738 Zeuthen

Die Echtzeit-Analyse von Neutrinoereignissen aus dem 1km^3 großen IceCube Neutrino Teleskop ermöglicht die sofortige Nachbeobachtung transienter Objekte mit optischen, Röntgen oder Gammastrahlungsteleskopen. Dies erlaubt das Studium von potenziellen astrophysikalischen Quellen in verschiedenen Kanälen, der so genannten 'Multi-Messenger-Astronomy'. Mit IceCube wird das Spektrum der Astronomie um den Neutrinokanal erweitert. Außerdem ermöglicht es mit seinem großen Gesichtsfeld den ganzen Himmel gleichzeitig zu beobachten und Nachfolgebeobachtungen zu triggern. Im Vortrag wird der aktuelle Stand des Echtzeit-Systems von IceCube vorgestellt, existierende 'Multi-Messenger-Programme' vorgestellt und ein Ausblick über geplante Erweiterungen gegeben.

T 96.10 Do 19:00 I.12.02 (HS 31)

Myon-Wirkungsquerschnitte in PROPOSAL: Auswirkungen der Simulation verschiedener Wirkungsquerschnitte in PROPOSAL — •Tomasz Fuchs, Mathis Börner und Tim Ruhe — TU Dortmund

Für die Datenanalyse von Neutrino-Untergrundexperimenten ist die detaillierte Berechnung der Propagation von Myonen und anderen Teilchen durch Materie von entscheidender Bedeutung. Wichtig sind hierbei vor allem Genauigkeit und Laufzeit der Simulation. Mit Hilfe der Software PROPOSAL (PRopagator with Optimal Precision and Optimized Speed for All Leptons) lassen sich geladene Leptonen unter Berücksichtigung der zuvor genannten Merkmale durch Materie propagieren. Diese Software ist bereits in der Version 2.0 verfügbar, welche um einige Funktionalitäten erweitert wurde. In diesem Vortrag wird ein kurzer Überblick über die verwendeten Wirkungsquerschnitte und Methoden gegeben. Weiterhin werden die Auswirkungen unterschiedlicher Parametrisierungen auf die Simulation neutrinoinduzierter Myonen gezeigt und die so auftretenden Unsicherheiten bei der Rekonstruktion des Neutrinoflusses vorgestellt.