T 61: Neutrinoastronomie III

Zeit: Dienstag 16:45–19:05 Raum: VMP9 SR 08

Gruppenbericht T 61.1 Di 16:45 VMP9 SR 08

Recent results from the IceCube Neutrino Observatory — •Sebastian Schoenen for the IceCube-Collaboration — 3. Physikalisches Institut B, RWTH Aachen

The IceCube Neutrino Observatory is a cubic-kilometer Cherenkov telescope buried deep in the glacial ice at the geographic South Pole. It is a multi-purpose detector covering a broad physics program in high-energy neutrino astronomy and particle physics. Already the data from IceCube's first few years of operation have revealed an excess of high-energy neutrino events in multiple detection channels from a few tens of TeV up to a few PeV. The flux observed at these energies is incompatible with a purely atmospheric origin and thus confirmed the existence of a high-energy extraterrestrial neutrino flux. However, the astrophysical sources of this flux still remain unresolved. In this talk we will provide an overview about recent IceCube results in the field of neutrino astrophysics.

T 61.2 Di 17:05 VMP9 SR 08

Optimization of the IceCube neutrino sample by improving the data processing chain — •Juliane van Scherpenberg, Kai Krings, Stefan Coenders, and Andrea Turcati for the IceCube-Collaboration — Technische Universität München

The IceCube Neutrino Observatory found evidence for astrophysical neutrinos. However, their sources are still unknown. In order to raise the probability of detecting these sources, the data processing chain can still be optimized with regard to more efficient event selection and background retention.

For a selection of neutrino-induced muon events studies were made on the effect of applying a new coincident-event splitting algorithm at low processing levels. Furthermore the impact of using a different numerical minimizer in the low-level likelihood reconstructions was investigated. The results of these studies - including arising changes at higher levels of reconstruction - are going to be presented in this talk.

T 61.3 Di 17:20 VMP9 SR 08

Unfolding Measurement of the Atmospheric Muon Neutrino Spectrum using IceCube — •Mathis Börner, Tim Ruhe, Maximilian Meier, Philipp Schlunder, Thorben Menne, and Tomasz Fuchs for the IceCube-Collaboration — Dept. of Physics, Technical University of Dortmund, 44227 Dortmund, Germany

IceCube is a cubic kilometer neutrino observatory located at the geographic South Pole. With its huge volume, the detector is well suited for measurements of the atmospheric muon neutrino energy spectrum. Over the last years, several unfolding analyses for single years were able to provide model independent measurements for the northern hemisphere in an energy region between 200 GeV and 3.2 PeV. In this talk, the extension of the analyses to four additional years of data is presented. With this significant enlargement of the data basis, it is possible to reanalyze the full northern hemisphere with smaller statistical errors. Moreover, the spectrum can be unfolded in several small zenith bands. Measurements of the energy spectrum for different zenith regions provide further information on the composition and the shape of the flux.

T 61.4 Di 17:35 VMP9 SR 08

Suche nach Tau-Neutrino-Ereignissen in IceCube — •Maximilian Meier, Mathis Börner, Thorben Menne, Philipp Schlunder, Tim Ruhe, Tomasz Fuchs und Alexander Sandrock für die IceCube-Kollaboration — Faktultät Physik, TU Dortmund, 44227 Dortmund, Deutschland

Die IceCube Kollaboration hat einen hochenergetischen, diffusen, astrophysikalischen Neutrinofluss nachgewiesen. Aufgrund von Neutrinooszillationen wird ein astrophysikalischer Fluss von Tau-Neutrinos vorhergesagt. Bisher wurden allerdings noch keine Tau-Neutrino-Signaturen im IceCube Detektor identifiziert. In diesem Vortrag werden erwartete Ereignisraten für verschiedene Tau-Signaturen und ein daraus resultierendes Analysekonzept vorgestellt. Die Selektion der Ereignisse soll dabei mit Hilfe von maschinellen Lernmethoden stattfinden. Dazu werden neben den typischen Ereignistopologien auch die Spannungszeitreihen der einzelnen DOMs herangezogen.

T 61.5 Di 17:50 VMP9 SR 08

KM3NeT/ARCA sensitivity to a diffuse cosmic neutrino flux — •Dominik Stransky for the ANTARES-KM3NeT-Erlangen-Collaboration — ECAP, Friedrich-Alexander-Universität Erlangen-Nürnberg

KM3NeT is a neutrino telescope being built in the Mediterranean Sea. In December 2015, a big step in the first construction phase has been achieved with the succesful deployment of the first detection unit. In a second phase, the full KM3NeT/ARCA detector, comprising 2 detector blocks with an instrumented volume of 1 cubic kilometre, will be built to investigate high-energy cosmic neutrinos. The high-energy cosmic neutrino flux must be distinguished against a background of atmospheric neutrinos and down-going tracks originating from atmospheric muons. Using Monte Carlo simulations, dedicated track and shower reconstruction algorithms have been developed allowing for a high precision in the determination of the kinematic event variables. For showers, the obtained energy resolution amounts to roughly 10% and the median angular resolution is less than 2 degrees, while in the track channel the angular and energy resolution is below 0.2 degress on average and about 0.27 in the logarithm of the energy, respectively. The reconstruction algorithms also provide reconstruction parameters that help to efficiently discriminate signal from background.

In this talk, an analysis dedicated to the sensitivity of KM3NeT/ARCA to a diffuse cosmic neutrino flux will be presented, incorporating a spectral fitting method, thus also being sensitive to the spectral shape of such a flux.

T 61.6 Di 18:05 VMP9 SR 08

Die Kalibration des Neutrinoteleskops KM3NeT — •Jonas Reubelt für die ANTARES-KM3NeT-Erlangen-Kollaboration — ECAP, Friedrich-Alexander-Universität Erlangen-Nürnberg

Der Aufbau des Neutrinoteleskops KM3NeT hat im Dezember 2015 mit der Installation der ersten Detektorstruktur (Detection Unit) vor der Mittelmeerküste von Sizilien begonnen. Eine Detection Unit besteht aus 18 Optischen Modulen, die mit einem Abstand von jeweils 36 m mit speziellen Kabeln zu einer vertikalen Struktur verbunden sind. Ein Optisches Modul ist mit 31 Photodetektoren bestückt und weist eine annähernd isotrope Sensitivität auf. Obwohl die Größe und somit die Sensitivität des Detektors durch das Hinzufügen von vielen weiteren Detection Units (mehrere 100) noch drastisch steigen wird, ist der Detektor in der derzeitigen Ausbaustufe bereits in der Lage atmosphärische Myonen und Neutrinos nachzuweisen. Hierzu bedarf es einer aufwendigen Kalibration der benutzten Hardware und Prozesse. Methoden und Ergebnisse der Kalibration werden im Vortrag vorgestellt.

T 61.7 Di 18:20 VMP9 SR 08

IceCube results from point-like source searches using seven years of through-going muon data — •Stefan Coenders and Elisa Resconi for the IceCube-Collaboration — Technische Universität München, Boltzmannstr. 2, 85748 Garching

The IceCube Neutrino Observatory located at the geographic South Pole was designed to study and discover high-energy neutrinos coming from both galactic and extragalactic sources. Track-like events induced by charged-current muon-neutrino interactions close to the IceCube detector give an angular resolution better than 1 degree above TeV energies. Within seven years of detector livetime, IceCube selects more than 700,000 events over the full sky, plus an additional component of almost 1000 events that are identified to be starting in the detector in the southern sky. Using this event sample, IceCube is sensitive to a steady neutrino flux substantially below $E^2\,\partial\phi\,/\,\partial E = 10^{-12}\,\mathrm{TeV\,cm^{-2}\,s^{-1}}$ in the northern sky for neutrino energies above 10 TeV. We report about the results in this search for steady point-like neutrino sources.

T 61.8 Di 18:35 VMP9 SR 08

Selektion atmosphärischer Myonneutrinos mit DeepCore — •Philipp Schlunder für die IceCube-Kollaboration — TU Dortmund

Der Fluss atmosphärischer Myonneutrinos ist für den Energiebereich von wenigen bis einigen Hundert GeV bisher noch nicht mit IceCube gemessen worden. Um eine hochauflösende Messung zu gewährleisten ist zunächst die Selektion eines reinen Datensatzes bestehend aus neutrinoinduzierten Myonen notwendig. In diesem Vortrag werden erste Ergebnisse einer solchen Selektion auf dem Weg zum rekonstruierten

Fluss gezeigt.

T 61.9 Di 18:50 VMP9 SR 08

Studying the cosmic-ray shadows of the Sun and the Moon with the IceCube neutrino telescope — •Fabian Bos and Julia Becker-Tjus for the IceCube-Collaboration — Ruhr-Universität Bochum

Cosmic rays are energetic charged particles from outer space that continuously impinge on Earth from all directions. As cosmic rays are blocked by the Sun and the Moon, a deficit in the number of cosmic rays is observed at Earth from the direction of these celestial bodies. The study of these cosmic-ray shadows has been traditionally used to characterize the angular resolution and absolute pointing of cosmic-ray detectors. We report on a five-year observation of the cosmic-ray Moon and Sun shadows detected with different configurations of the IceCube neutrino telescope, located at the South Pole. The cosmic-ray Moon shadow was observed with high statistical significance ($> 6\sigma$) in previous analyses of IceCube data, before the detector completion in December 2010. We present first results from the Sun and Moon shadow analyses with data from the completed detector. A dependence of the Sun shadow on solar activity is expected as particles propagating in the Sun's vicinity are influenced by its magnetic field. This opens the possibility for future analyses to probe different coronal magnetic field models.