T 58: Neutrinoastronomie 2

Zeit: Dienstag 16:45–19:10 Raum: H 1

Gruppenbericht T 58.1 Di 16:45 H 1

Das Neutrinoteleskop ANTARES: Ergebnisse nach 10 Jahren Datennahme — Thomas Eberl und •Steffen Hallmann für die ANTARES-KM3NeT-Erlangen-Kollaboration — Friedrich-Alexander-Universität Erlangen-Nürnberg / ECAP

Das ANTARES Experiment im Mittelmeer ist das erste erfolgreich in der Tiefsee betriebene Neutrinoteleskop. Nach zehn Jahren Datennahme wird ANTARES noch über das geplante Ende seiner Laufzeit hinaus bis Mitte 2017 betrieben werden.

Verschiedene Analysen in ANTARES suchen nach punktförmigen, ausgedehnten und – u.a. mit Hilfe eines umfangreichen Multimessenger-Programms – transienten Neutrinoquellen. Durch seine Position auf der Nordhalbkugel ist ANTARES dabei besonders sensitiv für einen möglichen galaktischen Neutrinofluss. Insbesondere bei der Suche nach Dunkler Materie können sehr konkurrenzfähige obere Ausschlussgrenzen gesetzt werden.

Der Vortrag rekapituliert die Meilensteine des Experiments, geht auf die neuesten Ergebnisse ein und umreißt die weiteren Pläne nach dem Ende der Datennahme. Ein besonderes Augenmerk wird dabei auf Analysen gelegt, bei denen das Erlangen Centre for Astroparticle Physics (ECAP) maßgeblich beteiligt war und ist. *Das Projekt wurde durch das BMBF (05A11WEA) gefördert.*

Gruppenbericht T 58.2 Di 17:05 H 1

Latest results and future perspectives of IceCube and IceCube-Gen2 — •Jan Auffenberg for the IceCube-Collaboration — Physikalisches Institut III B, RWTH Aachen University

The IceCube Neutrino Observatory is a cubic kilometer ice Cherenkov neutrino detector, located at the geographic South Pole, detecting neutrinos down to energies of about 10 GeV. Thanks to its size, IceCube can probe small fluxes of high-energy neutrinos (> 10 TeV) and in the last couple of years it has established the existence of a high-energy astrophysical neutrino flux at the level of $0.5 - 2.5 \cdot 10^{-18}(E/100\,\mathrm{TeV})^{-\gamma}\,\mathrm{GeV}^{-1}\mathrm{cm}^{-2}\mathrm{s}^{-1}\mathrm{sr}^{-1}$ per flavor and a spectral index γ of $2.0 - 2.7$ depending on the energy range and the underlying physics assumptions of the specific analysis. Features in the spectral shape, the flavor composition, and the identification of sources of this astrophysical neutrinos are central points of current analysis and are benchmark for future plans with IceCube-Gen2. DeepCore, a region of denser instrumentation at the lower center of the detector, detects low-energy atmospheric neutrinos (< 100 GeV), which are used to study neutrino oscillations with a precision comparable to that of the leading experiments in the field. The latest results and future plans of IceCube are discussed.

T 58.3 Di 17:25 H 1

Search for weak neutrino point sources in 6 years of IceCube data using an angular-correlation analysis — •Theo Glauch[1], Piotr Kalaczynski[1], Martin Leuermann[1], René Reimann[1], Julia Tjus[2], Lisa Schumacher[1], Joeran Stettner[1], and Christopher Wiebusch[1] — [1]RWTH Aachen — [2]Ruhr-Universität Bochum

The IceCube Neutrino Observatory has measured a diffuse all-sky all-flavor astrophysical neutrino flux above 30TeV. Nevertheless, dedicated searches for astrophysical neutrino point sources have not yet been successful, and the question about the production sites of astrophysical neutrinos remains inconclusive. There are, however, several theoretical models predicting classes of extragalactic sources which are abundant, but too faint to be detected individually. These weak sources could leave an overall signature in an angular-correlation analysis.

This talk presents the latest results from an angular correlation analysis performed on 6 years of IceCube data using the multipole expansion coefficients of spherical harmonics. The resulting implications for particularly interesting source classes such as Blazars and Fanaroff-Riley or Starburst Galaxies are discussed.

T 58.4 Di 17:40 H 1

Search for directional correlations of high-energy neutrinos in IceCube with astronomical source catalogs — •Piotr Kalaczynski, Theo Glauch, Martin Leuermann, René Reimann, Lisa Schumacher, Joeran Stettner, and Christopher Wiebusch for the IceCube-Collaboration — III. Physics Institute B, RWTH Aachen, Aachen, Germany

The IceCube Neutrino Observatory has measured a diffuse astrophysical muon neutrino flux with good directional information. So far, dedicated searches for astrophysical neutrino point sources have not been successful, and the production sites of astrophysical neutrinos remain undetermined. Nevertheless, there are several theoretical models predicting classes of extra-galactic sources which would be abundant, but too faint to be detected individually. A cross-correlation analysis of neutrino arrival directions with astronomical source catalogs is presented. An example is the the NVSS catalog of radio sources. The analysis is based on the multipole expansion coefficients of the neutrino sky map that are compared to the expansion coefficients of the catalog.

T 58.5 Di 17:55 H 1

IceCube results from blazar stacking searches using seven years of through-going muon data — •Matthias Huber and Stefan Coenders for the IceCube-Collaboration — Technische Universität München, Physik-Department, James-Franck-Str. 1, 85748 Garching

Located at the South Pole, the IceCube Neutrino Observatory is the world largest neutrino telescope. It instruments one cubic kilometre of Antarctic ice at a depth of about 1500m to 2500m including 5160 light detecting Digital Optical Modules. Since its construction the IceCube neutrino detector experienced remarkable success. Besides the detection of the highest energy neutrinos worldwide, IceCube is the first experiment to observe an astrophysical high-energy neutrino flux. Although in the meantime the collaboration detected more than 50 high energy neutrino events, the origin of these neutrinos is still not identified. Blazars, being a subclass of Active Galactic Nuclei and consequently one of the most powerful objects in the universe are supposed to be one of the most likely sources of high energy neutrinos. This scenario can be examined using stacking methods testing the correlation between IceCube neutrinos and the accumulation of hypothetical sources. We present here the results for three different blazar catalogs. The analyses are performed on 7 years of through-going muon data, taken by the IceCube Collaboration between 2008 and 2015.

T 58.6 Di 18:10 H 1

IceCube Punktquellenanalyse mit Core-Collapse Supernovae — •Alexander Stasik für die IceCube-Kollaboration — DESY, Zeuthen

Mit dem IceCube Neutrino-Detektor gelang der Nachweis von einem diffusen astrophysikalischen Neutrino-Fluss, dessen Quellen bisher unbekannt sind. Core-Collapse Supernovae gehören zu den plausiblen Quell-Klassen, da sie unter geeigneten Bedingungen hochenergetische Neutrinos produzieren. Dafür wird eine effiziente Beschleunigung von geladenen Teilchen (hauptsächlich Protonen) sowie ausreichend Target-Material benötigt, bei den in hadronischen Wechselwirkungen Neutrinos erzeugt werden. Diese Bedingungen sind gegeben bei der Explosion von massereichen Sternen in einer sehr dichten Sternumgebung oder innerhalb der Sternhülle. Die hier vorgestellte Analyse nutzt sieben Jahre IceCube Neutrino Daten für eine Korrelationsstudie zwischen optischen Supernova Daten und Neutrino-Ereignissen. Dabei werden die erwarteten Signale von verschiedenen Quellen kombiniert (Stacking). Um den atmosphärischen Untergrund zu verringern, wird die erwartete Zeitabhängigkeit des Neutrinosignals berücksichtigt. Diese Methode ist zum ersten Mal sensitiv genug einen Beitrag von Core-Collapse Supernovae zum astrophysikalischen Neutrinofluss zu entdecken oder den Modelparameterraum für Neutrinoproduktion in Core-Collapse SNe einzuschränken. Sensitivitäten für verschiedene Supernovae-Klassen und erste Ergebnisse werden vorgestellt.

T 58.7 Di 18:25 H 1

Search for Neutrino Emission from the Galactic Plane with IceCube — •Christian Haack, Leif Rädel, René Reimann, Sebastian Schoenen, and Christopher Wiebusch for the IceCube-Collaboration — III. Physikalisches Institut B, RWTH Aachen

The IceCube Neutrino Observatory has observed a diffuse all-sky all-flavor astrophysical neutrino flux above 30TeV. This flux has also been confirmed using up-going muon neutrinos above 200TeV from the Northern Hemisphere. In addition to searches for point sources, IceCube is able to probe models for diffuse neutrino emission from

the galactic plane. In the galactic plane neutrinos are produced by the interaction of cosmic rays with the interstellar medium. The resulting neutrino energy spectrum is given by the cosmic ray propagation model and the properties of cosmic ray accelerators. In this talk, we will present results of a likelihood-based search for neutrino emission from the galactic plane, using six years of IceCube up-going muon neutrino data.

T 58.8 Di 18:40 H 1

Search for neutrino emission from the Galactic plane with IceCube using starting events — •Kai Krings[1] and Christian Haack[2] for the IceCube-Collaboration — [1]Technische Universität München, Physik-Department, James-Franck-Str. 1, 85748 Garching — [2]III. Physikalisches Institut B, RWTH Aachen, Otto-Blumenthal-Str., 52074 Aachen

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 results of a proof-of-concept analysis, based on a forward-folding likelihood template fit, using two years of starting event data and introduce a follow-up analysis with six years of data and combined with the up-going muon neutrino search.

T 58.9 Di 18:55 H 1

Constraints on New Physics from IceCube Neutrino Flavor Composition Measurements — •Lukas Lechner for the IceCube-Collaboration — DESY Zeuthen, Germany

IceCube measured for the first time the flavor composition of high-energy cosmic neutrinos (E > 10 TeV). This measurement is a powerful tool to constrain the production mechanisms of astrophysical neutrinos and investigate potential deviations from Standard Model predictions. In this work, the influence of matter effects at the source, neutrino decay and light sterile neutrinos on the expected neutrino flavor ratio from astrophysical sources are studied. In particular, the effects on the flavor composition of pseudo-Dirac neutrinos with mass squared differences $\delta m^2 < 10^{-16}$ eV^2 between the active and sterile states are examined. For such small mass differences oscillation phenomena could only be observed over cosmic baselines. The scenarios studied take into account current constraints and uncertainties on the neutrino mass differences and the 3×3 mixing (sub-)matrix. The expected effects on the observable flavor composition are presented and compared to current constraints from the IceCube detector, as well as the expected sensitivity of the envisioned IceCube-Gen2 neutrino telescope.