T 82: Neutrinoastronomie 3

Zeit: Mittwoch 16:45–18:50 Raum: H 1

Gruppenbericht T 82.1 Mi 16:45 H 1

KM3NeT - Status und Perspektiven — •Stefan Geisselsöder für die ANTARES-KM3NeT-Erlangen-Kollaboration — Friedrich-Alexander-Universität Erlangen-Nürnberg — ECAP

KM3NeT ist eine im Aufbau befindliche Forschungsinfrastruktur am Grund des Mittelmeeres. Die Hauptziele des Projekts, die Erforschung des Kosmos mit und der Eigenschaften von Neutrinos, werden mithilfe von zwei technisch identischen Wasser-Cherenkov-Detektoren ermöglicht. KM3NeT/ARCA, mit einem instrumentierten Volumen von etwa einem Kubikkilometer, wird gegenwärtig vor der Küste Siziliens in einer Wassertiefe von 3500m aufgebaut. Der Detektor wurde optimiert um die Quellen des Flußes hochenergetischer kosmischer Neutrinos zu entdecken, dessen Existenz inzwischen von IceCube nachgewiesen wurde. Dieselbe Technologie wird von KM3NeT/ORCA genutzt, welches vor der französischen Küste in einer Wassertiefe von 2500m aufgebaut wird. Durch Auswerten der energie- und zenitwinkelabhängigen Oszillationswahrscheinlichkeit niederenergetischer atmosphärischer Neutrinos soll die Massenhierarchie bestimmt und damit eine der wichtigsten offenen Fragen der Neutrinophysik beantworten werden.

Der Vortrag gibt einen Überblick über den gegenwärtigen Status des Aufbaus, der bereits angelaufenen Datennahme sowie einen Ausblick auf einige der Analysen, die durch dieses Projekt in naher Zukunft ermöglicht werden. Der Fokus liegt auf den vielfältigen Beteiligungen der ECAP-Neutrinogruppe.

T 82.2 Mi 17:05 H 1

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

KM3NeT is an extensive undersea research infrastructure currently in Phase 1 of construction. KM3NeT/ARCA will be the instrument dedicated to high-energy neutrino astronomy in Phase 2.0, and will consist of two 'blocks' 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 greatest fraction 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, and the astrophysical flux, will generate incoming muons from all directions, with different energy dependencies. Studies aiming to identify the flavour composition of the astrophysical flux, and/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 – these contributions may be disentangled.

T 82.3 Mi 17:20 H 1

Stacking point source search of low energy contribution at the HESE track positons — •Thorben Menne for the IceCube-Collaboration — TU Dortmund

The IceCube detector is a cubic kilometer sized neutrino telescope located at the South Pole. One main goal is to observe neutrinos originating from a single or multiple sources in the sky. Despite the discovery of multiple neutrinos of astrophysical origin no significant source of these high energy events has been found in a point source follow-up analysis yet. Also no significant clustering of lower energy neutrinos at a single point has been found in a search with 7 years of IceCube data. This analysis aims to find a signal from lower energy neutrinos originating from the positions of HESE track events with a stacking method. It is searched for combined spatial clustering of lower energy events at those source locations. The usual stacking likelihood approach is used which combines signal from all source positions. Because the HESE events and thus the source positions have a positional uncertainty due to event reconstruction a slight modification in the fitting procedure is used. The positions are not kept fixed but are allowed to vary, using the full sky reconstruction likelihood landscape for each event as a prior to constrain the source positions around their original best fits.

T 82.4 Mi 17:35 H 1

Search for neutrino point sources with an all-sky autocorrelation analysis in IceCube — •Andrea Turcati, Stefan Coenders, and Anna Bernhard for the IceCube-Collaboration — TUM, Munich, Germany

The IceCube Neutrino Observatory is a cubic kilometre scale neutrino telescope located in the Antarctic ice. Its full-sky field of view gives unique opportunities to study the neutrino emission from the Galactic and extragalactic sky. Recently, IceCube found the first signal of astrophysical neutrinos with energies up to the PeV scale, but the origin of these particles still remains unresolved. Given the observed flux, the absence of observations of bright point-sources is explainable with the presence of numerous weak sources. This scenario can be tested using autocorrelation methods. We present here the results of a two-point angular correlation analysis performed on seven years of IceCube data, taken between 2008 and 2015. The test is applied on the northern and southern skies separately, using the neutrino energy information to improve the effectiveness of the method. A dedicated additional analysis is also performed on the Cygnus Region: an active and massive star-forming complex situated in our galaxy.

T 82.5 Mi 17:50 H 1

Search for High Energy Astrophysical Tau Neutrinos with IceCube — •Maximilian Meier and Mathis Börner for the IceCube-Collaboration — TU Dortmund, Dortmund, Deutschland

The IceCube Neutrino Observatory at the South Pole is a Cherenkov detector designed to measure astrophysical neutrinos of all flavors. High energy tau neutrinos interacting inside the detector produce two cascades separated by the tau lepton decay length. At energies above 100 TeV the spatial separation can be resolved within the waveform of one IceCube optical module and identified as a double pulse signature. This work aims to select events with a cascade-like topology that contain at least one double pulse signature.

T 82.6 Mi 18:05 H 1

Search for High-Energy Tau Neutrino Interactions in IceCube — •Juliana Stachurska for the IceCube-Collaboration — DESY Zeuthen

The IceCube Neutrino Observatory at the South Pole detects Cherenkov light from charged particles produced in neutrino interactions. At the highest energies, the neutrino flux is of cosmic origin, with an expected flavor ratio of ν_e:ν_μ:ν_τ of 1:1:1, but its astrophysical sources are yet unknown. A measurement of the flavor ratio on Earth can provide important information to constrain sources and production mechanisms. But as of today, no high energy tau neutrino interaction has been identified in the IceCube data, leaving the ν_τ fraction of the cosmic neutrino flux largely unconstrained. This work aims at identifying high-energy tau neutrino interactions creating tau leptons with a mean decay length of 50m per PeV neutrino energy. Above energies of $\sim$ 100 TeV they produce a unique Double Bang signature with two cascades from the neutrino interaction and the subsequent tau decay that are potentially resolvable in IceCube.

T 82.7 Mi 18:20 H 1

Measurement of atmospheric anti-neutrino/neutrino-ratio with Icecube — •David Kappesser, Sebastian Böser, Gerald Krückl, and Lutz Köpke for the IceCube-Collaboration — Johannes Gutenberg-Universität, Mainz, Deutschland

Models on atmospheric neutrino flux suffer from a uncertainty of about 20% from modeling hadronic interactions. It is therefore interesting to measure parameters that may constrain this. Cherenkov detectors like IceCube in general can not differentiate between particles and antiparticles. However for charged current interactions where hadronic cascade and a sufficient fraction of the created leptons energy is contained, it is possible to measure the inelasticity from the energy deposition along the track. Particles and antiparticles experience different quark density functions in the nucleus, the cross section as a function of inelasticity differs. Selecting a pure sample of sufficiently contained events and fitting the Monte-Carlo event rate as a function of inelasticity to the data allows measuring the neutrino-antineutrino ratio.

T 82.8 Mi 18:35 H 1

Neutrino mass determination using extragalactic supernovae — •Maike Jung and Sebastian Böser for the IceCube-Collaboration — JGU Mainz, Mainz, Germany

MICA, the Megaton Ice Cherenkov Array, is a hypothetical low energy extension for IceCube. With optimized optical modules and a much higher instrumentation density MICA could detect neutrinos down to an energy of 10 MeV, allowing the trigger on supernovae (SN) up to a distance of 10 Mpc. This will enable the observation of up to 1-4 SN per year, a significant improvement to the 1 per century rate of IceCube. Due do the mass of the neutrinos a time delay, especially of the lower energetic neutrinos, is expected. This causes a specific shift in the arrival time spectrum of these SN-neutrinos that also depends on the distance to the SN. This effect is more prominent the further away the detected SN, therefore the limits obtained from extragalactic SN detection with MICA will be a significant improvement to those from SN1987A. I present simulation results on how accurate the neutrino mass can be determined.