T 16: Neutrino Astronomy I

Time: Monday 16:30–18:00 Location: POT/0112

T 16.1 Mon 16:30 POT/0112

Quasi-periodic oscillations in J1048.4+714 - comparison of hadronic and leptonic signatures* — •Tom Mianecki[1,2], Julia Becker Tjus[1,2], and Leander Schlegel[1,2] — [1]Theoretische Physik IV, Ruhr Universität Bochum, Bochum, Germany — [2]RAPP-Center at Ruhr Universität Bochum, Bochum, Germany

Active Galactic Nuclei belong to the most luminous known astrophysical sources of high energy radiation. They are assumed to produce charged particles as well as uncharged messengers as photons and neutrinos via leptonic as well as hadronic processes and show a strong time-variability in their corresponding light curves. The quasi-periodic behaviour of the recently analyzed light curve of the source J1048.4+714 especially raises the question of the creation of such temporal structures. One explanation is that the shape of the light curve stems from a precessing jet. In this work, we compare the photon flux produced via the $pp \to \pi^0 \to \gamma\gamma$ channel and the photon flux produced from synchrotron self-compton scattering in dependence of parameters of the emitting region. Furthermore, we investigate the differences of the flaring durations of the source defined by two methods, i.e. full-width at half-maximum method and the centroid method. Finally we evaluate the results with respect to the curvature parameter of the SEDs in the flaring phase. With these investigations we aim to reach a better understanding of the quasi-periodic oscillations in AGN and the interpretation of high-energy radiation signatures.

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T 16.2 Mon 16:45 POT/0112

Search for periodic low energy neutrino sources — •Maximilian Eff for the ANTARES-KM3NET-ERLANGEN-Collaboration — ECAP, Friedrich-Alexander Universität Erlangen-Nürnberg (FAU), Erlangen, Germany

Pulsars are rotating neutron stars that emit beams of electromagnetic radiation. Neutrino emission from pulsars has been the subject of phenomenological models during the last decades. So far, experimental data has not shown any neutrino emission at high energies. This contribution reports about the development of a novel search approach that aims at identifying low-energy (below 10 GeV) neutrinos from periodic sources with a neutrino telescope. This is done by applying a Fast Fourier Transformation to the PMT counting rate time series.

T 16.3 Mon 17:00 POT/0112

Study of high-energetic muon deflections * — •Pascal Gutjahr — TU Dortmund University, Dortmund, Germany

The analysis of incoming muon-neutrinos and muons relies on the reconstruction of the detected muons. In general, the energy and the direction of an incoming particle are estimated via likelihood methods. With new reconstruction algorithms and hardware optimizations, the direction of an incoming muon can be measured with an angular resolution lower than 1 degree.

However, high-energetic muons are able to travel many kilometers through dense media like ice and water. In these media, the muons interact very frequently with energy losses of up to 90% of the muon energy and even larger energy losses are possible. In each interaction, there is a momentum transfer which leads to a small deflection of the initial muon direction.

In this presentation, the lepton simulation framework PROPOSAL is used to estimate the accumulated muon deflection. Muons with different energies are propagated through ice and water over several distances. Data-Monte-Carlo comparisons as well as comparisons with the simulation tools MUSIC and Geant4 are shown. Finally, the impact of muon deflections for large scale neutrino telescopes is discussed.

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T 16.4 Mon 17:15 POT/0112

Image Recognition Algorithm for Deep Sea Bioluminescence — •Sophie Loipolder and Kilian Holzapfel for the P-ONE-Collaboration — Technical University of Munich, Munich, Germany

The Pacific Ocean Neutrino Experiment (P-ONE) is a planned, cubic-kilometer-scale neutrino telescope in the Pacific Ocean off the coast of Vancouver, Canada. Two pathfinder experiments have already been deployed: STRAW (STRings for Absorption length in Water) in 2018 and STRAW-b in 2020. Both pathfinder experiments are connected to the NEPTUNE deep-sea observatory, an initiative of Ocean Networks Canada (ONC). In the deep sea, light produced by bioluminescent organisms presents a particular background for neutrino detection, although the bioluminescence data obtained are valuable for interdisciplinary research. The cameras installed in STRAW-b allow a visual detection of the bioluminescence. In this contribution, we present an image recognition algorithm including a deep neural network to analyze the bioluminescence on the pictures.

T 16.5 Mon 17:30 POT/0112

Applications of an improved track reconstruction algorithm in IceCube — •Sofia Athanasiadou for the IceCube-Collaboration — DESY, Zeuthen, Germany

The IceCube Neutrino Observatory, the world's largest neutrino telescope, has detected neutrinos in spatial and time coincidence with AGN, providing strong evidence that these astrophysical objects can in fact be neutrino sources. Neutrinos of astrophysical origin can be discerned from the atmospheric background at energies above 100 TeV, and for point-source studies in particular, high-energy track-like events are preferred. In this energy regime, the stochastic energy losses of the neutrino-induced muons are the dominant source of Cherenkov light measured by the detector, thus it is essential to include them in our reconstruction methods. The SegmentedSpline reconstruction algorithm incorporates stochastic losses into the energy loss pattern while performing an energy fit as a first step, which significantly improves on the subsequent track reconstruction step and the angular resolution achieved. In this work we present our results when the algorithm is run on a subsample of simulated events for validation purposes, and our plans for implementation on IceCube data for a point-source search study.

T 16.6 Mon 17:45 POT/0112

Flavor differentiation for in-ice radio neutrino detectors — •Janna Vischer for the RNO-G-Collaboration — Erlangen Centre for Astroparticle Physics, Erlangen, Germany

Cosmogenic neutrinos (> PeV) can be detected via the Askaryan effect when they interact and induce particle showers in ice. The thereby created radio signals can be observed using large scale antenna arrays. This is currently done at the Radio Neutrino Observatory Greenland (RNO-G) and planned for the radio component of IceCube-Gen2. The capability to differentiate neutrino flavors would be an asset for such experiments. In the event of deep-inelastic scattering, neutrino interactions produce either an undetectable neutrino (neutral-current interaction) or an electron, muon, or tau lepton (charged-current interaction), both occasionally accompanied by measurable hadronic showers. In the second case extremely high energetic muons and taus themselves radiate secondary showers along their tracks. Particle showers with an energy above PeV can be detected. In this contribution we investigate how the signatures of these secondary showers can be used to deduce the flavor of the original neutrino in radio neutrino detectors.