EP 12: Astrophysics I - High-energy and Relativistic Astrophysics

Zeit: Donnerstag 17:30–18:30 Raum: BSZ - Pabel HS

EP 12.1 Do 17:30 BSZ - Pabel HS

On the Detection Potential of Short Blazar Flares for Current Neutrino Telescopes — •Michael Kreter[1], Matthias Kadler[1], Felicia Krauss[2], Karl Mannheim[1], and Joern Wilms[3] — [1]Lehrstuhl für Astronomie, Universität Würzburg, Emil-Fischer-Strasse 31, 97074 Würzburg, Germany — [2]Anton Pannekoek Institute for Astronomy, University of Amsterdam, Postbus 94249, 1090 GE Amsterdam, Netherlands — [3]Dr. Remeis Sternwarte & ECAP,Universität Erlangen-Nürnberg, Sternwartstrasse 7, 96049 Bamberg, Germany

High-confidence associations of individual neutrinos with individual blazars could be achieved via spatially and temporally coincident detections of high-energy neutrinos (>100 TeV) from short blazar flares. It has been suggested that the current IceCube neutrino detector is sufficiently sensitive to detect neutrinos from such short flares. We test this prediction by calculating the expected number of neutrinos produced in the IceCube detector for the 50 brightest short blazar flares in the sky. We find that the fluence of most individual blazar flares is far too small to yield a substantial Poisson probability for the detection of one or more neutrinos with IceCube. The integrated fluence of the 50 highest-ranked flares yields only about 50% of Poisson probability for the detection of a single high-energy neutrino. For the most spectacular short blazar flares, however, Poisson probabilities of up to 2% are calculated, so that the possibility of associated neutrino detections in future data unblindings of IceCube and KM3NeT seems reasonable.

EP 12.2 Do 17:45 BSZ - Pabel HS

The blazar family as a joint source of neutrinos and cosmic-ray nuclei — •Xavier Rodrigues, Anatoli Fedynitch, Shan Gao, Denise Boncioli, and Walter Winter — DESY Zeuthen

The origin of the ultra-high-energy cosmic rays (UHECR) and the astrophysical neutrinos observed by IceCube is a subject still shrouded in mystery. PeV-energy neutrinos must originate from (photo-)hadronic interactions in astrophysical environments that are able to accelerate and confine UHECR. However, the stacking analyses by IceCube have not yet unveiled a correlation between the directions of astrophysical neutrinos and known gamma-ray sources. This may indicate that a population of yet undetected extragalactic objects may be responsible for the cosmic-ray and diffuse neutrino fluxes. In this work we investigate blazars (relativistic outflows driven by super-massive black holes) as multi-messenger sources, under the assumption that they contain accelerated nuclei heavier than protons in the jet. Our calculation includes a sophisticated model of photo-nuclear interactions within the source and a three-zone model to take into account external photon fields in Flat Spectrum Radio Quasars (FSRQs). We then compute and study the emission of cosmic rays and neutrinos across the blazar sequence. Our results demonstrate that the neutrino and cosmic ray production efficiencies are inversely related to each other with respect to the source luminosity, and that there is no ideal source for the emission of both messengers. In our latest calculations, we study the contributions from different blazar classes to the diffuse cosmic-ray and neutrino flux.

EP 12.3 Do 18:00 BSZ - Pabel HS

Detecting and quantifying the relativistic Kelvin-Helmholtz instability in interstellar jets via radiation observable on Earth — •Richard Pausch[1,2], Michael Bussmann[1], Axel Huebl[1,2], Ulrich Schramm[1,2], Klaus Steiniger[1,2], René Widera[1], and Alexander Debus[1] — [1]Helmholtz-Zentrum Dresden - Rossendorf — [2]TU Dresden

We present a microscopic model of the radiation emitted during the relativistic Kelvin-Helmholtz instability (KHI) and validate our findings with particle-in-cell simulations at unprecedented spatial resolution and size that including complete far-field radiation spectra.

The KHI is expected in shear flow regions of astrophysical plasma jets, which are significant sites for particle acceleration and radiation. We demonstrate that the emitted polarized radiation can be used to identify and characterize the microscopic plasma dynamics of a KHI light-years away. We have simulated the radiation of the KHI using the particle-in-cell code PIConGPU. With this code's synthetic radiation diagnostic, based on Liénard-Wiechert potentials, quantitative predictions of the far field radiation for hundreds of observation directions and a frequency range covering 3 orders of magnitude were performed on the TITAN cluster at Oak Ridge National Laboratory. The simulation showed that the time-dependent changes in the radiation polarization and power correlate directly with the stages of the KHI. This allows identifying the linear growth phase of the KHI and quantifying its characteristic growth rate as predicted by our microscopic model.

EP 12.4 Do 18:15 BSZ - Pabel HS

Flux sensitivity of a mono MST telescope — •Thomas Jung — Tu Dortmund, Dortmund, Deutschland

The ground-based gamma-ray astronomy have a huge potential in astrophysics and cosmology. The Cherenkov telescope array (CTA) is covering the Energy from 100MeV to 100TeV.

To compare CTA with other telescopes the flux sensitivity is very important. Therefor we calculate the sensitivity of a mono MST telescope in the Energy range of 3GeV to 350TeV to check the sensitivity improvement. This talk will give an introduction how to calculate the flux sensitivity for CTA telescopes.