T 86: Multi-Messenger

Zeit: Donnerstag 16:00–18:30 Raum: S13

T 86.1 Do 16:00 S13

Automatic Neutrino Follow-Up Searches with the Pierre Auger Observatory — •Michael Schimp — Bergische Universität Wuppertal, Gaußstr. 20, 42119 Wuppertal

The Pierre Auger Observatory is sensitive to ultra-high energy neutrinos (UHE neutrinos; $E_\nu > 0.1$ EeV) due to the discriminability of neutrino-induced air showers from nucleus-induced air showers at high inclinations ($60° < \theta < 95°$), and the Observatory's large acceptance. Its sensitivity to a diffuse UHE neutrino flux is competitive to the sensitivity of other neutrino detectors. Additionally, its field of view, spanning the declination region from $-85°$ to $60°$, is changing throughout the day and its exposure is non-uniform in inclination, meaning that it samples different regions of the sky with much enhanced sensitivity for certain fractions of the day. Therefore, it is very sensitive to transient sources that are in its field of view at the time of increased emission. One example demonstrating this was the follow-up search of the source of GW170817, the first ever observed binary neutron star merger. In this search, the sensitivity of the Pierre Auger Observatory to prompt UHE neutrino emission exceeded the sensitivities of the other instruments by at least an order of magnitude. Also, a procedure to automatically follow up the open public alerts of the current observing run (O3) of the LIGO/Virgo gravitational wave observatories will be shown.

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T 86.2 Do 16:15 S13

Search for correlations of high-energy neutrinos and ultra-high-energy cosmic rays — •Lisa Schumacher, Christian Haack, Philipp Muth, Saskia Philippen, Rene Reimann, and Christopher Wiebusch for the IceCube-Collaboration — III. Physikalisches Institut B, RWTH Aachen

The IceCube Neutrino Observatory has recently found compelling evidence for a particular blazar producing high-energy neutrinos and PeV cosmic rays, however the sources of cosmic rays above several EeV remain unidentified. It is believed that the same environments that accelerate ultra-high-energy cosmic rays (UHECRs) also produce high-energy neutrinos via hadronic interactions of lower-energy cosmic rays. Two out of three joint analyses of the IceCube Neutrino Observatory, the Pierre Auger Observatory and the Telescope Array yielded hints for a possible directional correlation of high-energy neutrinos and UHECRs. These hints however became less significant with more data. Recently, an improved analysis with an approach complementary to the other analyses has been developed. This analysis searches for neutrino point sources in the vicinity of UHECRs with search windows estimated from deflections by galactic magnetic fields. We present this new analysis method and its preliminary results for searching common hadronic sources, additionally including neutrino data measured by ANTARES in order to increase the sensitivity to possible correlations in the Southern Hemisphere.

T 86.3 Do 16:30 S13

The impact of the mass composition of ultra-high-energy cosmic rays on the correlation with high-energy neutrinos — •Philipp Muth, Christian Haack, Saskia Philippen, Rene Reimann, Lisa Schumacher, and Christopher Wiebusch for the IceCube-Collaboration — III. Physikalisches Institut B, RWTH Aachen

The search for sources of highly energetic cosmic messengers such as ultra-high-energy cosmic rays (UHECRs) with an energy above several EeV and cosmic neutrinos is an active field of research as these sources have remained unidentified to date. UHECRs and neutrinos are suspected to share common sources, which motivates a multi-messenger approach correlating the data from different experiments. UHECRs, unlike neutrinos, are deflected by magnetic fields depending on their rigidity, and this deflection has to be accounted for when searching for these common sources. While no quantitative consensus on the mass composition of UHECRs at the EeV-range has been reached, assumptions on the resulting rigidities need to be assessed. In this talk, the impact of the UHECR mass composition on a correlation analysis of UHECR and neutrino data will be discussed.

T 86.4 Do 16:45 S13

Follow-Up Search for UHE Photons after Gravitational Wave Events with the Pierre Auger Observatory — Philip Ruehl, •Marcus Niechciol, and Markus Risse — Universität Siegen, Department Physik

With the first detection of a gravitational wave event by the Advanced LIGO detectors in September 2015 a new window to multimessenger astronomy has been opened. The origin of this event has later been identified as the merger of a binary black hole system. Since then, multiple gravitational wave events have been observed from different sources. Possibly, these transient objects could be sources of ultra-high-energy (UHE) cosmic rays. This can be tested by multimessenger observations. Unlike charged particles, neutral messengers like neutrinos and photons carry information about the direction and the time of their production site making them ideal tools for multimessenger astronomy. While in classical scenarios photons can interact with the cosmic microwave background such that a measurable UHE photon fraction would only be expected from nearby sources, a UHE photon detection from a distant source could point towards new physics.
To extend the search window of the Pierre Auger Observatory, in addition to the established neutrino follow-up search now also a photon follow-up is being developed. In this contribution, the first approach towards an UHE photon follow-up search using the surface detector of the Pierre Auger Observatory will be presented.

T 86.5 Do 17:00 S13

Neutrinos und Gravitationswellen aus Verschmelzungen binärer super-massiver Schwarzer Löcher — •Ilja Jaroschewski — Ruhr-Universität Bochum, Bochum, Deutschland

Am 14ten September 2015 detektierte das Laser Interferometer Gravitations-Wellen Observatorium (LIGO) das erste Gravitations-Wellen Signal, GW150914, das aus der Verschmelzung eines binären Schwarzen Lochs entstand. Nachfolgeuntersuchungen konnten keine Koinzidenz-Emission von elektromagnetischen Wellen oder Neutrinos detektieren.

Aus der Nicht-Detektion von Neutrinos haben K. D. de Vries et al. in ihrer Arbeit untersucht, wie viele solcher Verschmelzung detektiert werden müssten, um sie als Quellen des, vom IceCube Neutrino Observatorium gemessenen, diffusen astrophysikalischen Neutrino-Flusses ausschließen zu können. Dazu wurde ein Parameter eingeführt und bestimmt, der das Verhältnis von freigesetzter Energie in Form von Neutrinos zu der in Form von Gravitationswellen beschreibt.

In meiner Master-Arbeit übertrage ich diese Untersuchungen auf Verschmelzungen binärer super-massiver Schwarzer Löcher, die Millionen bis Milliarden größere Massen als unsere Sonne besitzen, und teste, ob solche Ereignisse als Quellen des diffusen Neutrino-Flusses in Betracht kommen oder ausgeschlossen werden können.

T 86.6 Do 17:15 S13

Exploring astrophysical counterparts of high energy neutrino events from IceCube — •Pratush Mallik, Rene Reimann, and Christopher Wiebusch for the IceCube-Collaboration — III. Physikalisches Institut B, RWTH Aachen

Multi-messenger astronomy incorporates signals from different cosmic messengers to have a deeper understanding of the properties of an object under consideration, and enhancing the potential to discover new sources. The IceCube Neutrino Observatory has detected spectacular high energy neutrino events. We correlate these high energy neutrino events to known sources from various astronomical catalogs from electromagnetic observations. The talk reports the findings of these studies.

T 86.7 Do 17:30 S13

Gamma-ray counterparts of the IceCube track-type high-energy neutrino events — •Simone Garrappa — DESY Zeuthen

The IceCube neutrino observatory sends public alerts in realtime for the most interesting muon-neutrino track events. Observations performed by the Large Area Telescope (LAT) on board of the Fermi Gamma-ray Space Telescope revealed a flaring gamma-ray blazar, TXS 0506+056, in spatial and temporal coincidence with the neutrino event IceCube-170922A. The presented work searches for further coincidences of high-energy neutrinos with Fermi gamma-ray sources.

We find another high-energy neutrino in spatial coincidence with the gamma-ray blazar GB6 J1040+0617. We study this source in detail using 9.6 years of Fermi-LAT data in the 100 MeV - 1 TeV energy range and find that the energetics and the multi-wavelength behavior of the source make it a plausible neutrino source candidate.

T 86.8 Do 17:45 S13

The diffuse gamma-ray excess from the galactic center and its correlation with CO emission — •Iris Gebauer[1], Neeraj Amin[1], Wim de Boer[1], and Peter Biermann[2] — [1]Karlsruhe Institute of Technology, Karlsruhe, Germany — [2]Universität Bonn and University of Alabama

The Fermi-LAT has observed an excess in the diffuse emission from the Galactic center around a few GeV. This excess was previously observed by the EGRET instrument onboard CGRT, but the accurate Fermi-LAT data have triggered significant interest in the origin of the excess. Possible interpretations discussed in the literature are the annihilation or the decay of dark matter, a population of milisecond pulsars and emission from molecular clouds. We have found a correlation with the distribution of molecular clouds, traced by the CO emission line. Assuming that the excess emission indeed originates from molecular clouds we determined the spectrum of this component of gamma radiation from the Fermi-LAT data. The derived spectrum is compatible with a depletion of gamma-ray production within molecular clouds.

T 86.9 Do 18:00 S13

Multi-Messenger emission in Gamma-Ray Bursts — •Annika Rudolph, Jonas Heinze, Anatoli Fedynitch, and Walter Winter — Deutsches Elektronen-Synchrotron (DESY)

Due to the large amounts of energy they release, the extremely luminous transients called Gamma-Ray Bursts (GRBs) are of great interest for high energy astroparticle physics. In the fireball internal shock scenario, particle acceleration occurs in collisions between regions of the jet with different Lorentz factors. Usually, the observed prompt emission is attributed to synchrotron emission from accelerated electrons. However, if cosmic rays (baryons and nuclei of high energies) are contained in the outflow, they will be co-accelerated with electrons and might produce signatures in the electromagnetic spectrum. Besides, their interactions with the present photon fields will lead to the production of secondary neutrinos. In this talk, I will discuss the production of multiple astrophysical messengers within the internal shock scenario, focussing on the constraints on cosmic ray production that come from neutrino and gamma-ray observations.

T 86.10 Do 18:15 S13

Testing the Pierre Auger Observatory starburst galaxy correlation aided anisotropy result with CR Propa simulations. — •Wilson Namasaka, Karl - Heinz Kampert, and Eric Mayotte — Bergische Universität Wuppertal-Germany, Gaußstr. 20, 42119 Wuppertal

Intermediate scale anisotropies in the distribution of UHECR arrival directions can be associated with two prominent classes of extragalactic gamma-ray sources detected by Fermi-LAT. In a recent study, a correlation between the arrival direction of cosmic rays at energies above 39 EeV and the positions of starburst galaxies was reported by the Pierre Auger Collaboration with a 4.0σ statistical significance when the observed gamma-ray Luminocity used as a proxy for cosmic ray Luminocity. In the study, the predicted cosmic-ray excess maps were created using an angular smearing parameter fit to the observed arrival direction distribution via an optimization scan. In this research, we investigate the viability of this angular smearing using CRPropa simulations to test whether the results of the Pierre Auger Observatory study can be reproduced by the deflections expected due to magnetic fields. Preliminarily, we have selected the five strongest gamma-ray sources in both the Fermi-LAT AGN and the SBG catalogs and match our CR arrival intensity to the 1.4 GHz emmissions Luminosity for each of these sources. Simulations of the flux from these sources including extragalactic and galactic fields will be presented in this talk.*Gefördert durch die BMBF Verbundforschung Astroteilchenphysik(Vorhaben 05A17PX1).