# T 119: Neutrino Astronomy IV

Time: Thursday 15:50–17:05 Location: POT/0112

T 119.1 Thu 15:50 POT/0112

**Search for neutrinos from AGN using a machine-learning-based source selection** — •Sebastian Schindler for the IceCube-Collaboration — ECAP, University Erlangen-Nürnberg, Germany

The IceCube Neutrino Observatory is currently the world's largest high-energy neutrino detector. After the detection of a diffuse astrophysical neutrino flux in 2013, one of the main goals has been to associate parts of this flux with specific source classes. A few "hot spots" at or above the three-sigma level have been found and associated with certain classes of Active Galactic Nuclei (AGN). Most recently, the Seyfert II galaxy NGC 1068 was associated with a neutrino flux at a significance of $4.2\,\sigma$, and there is growing evidence for a neutrino flux from blazars. However, the underlying physical processes of neutrino production remain poorly understood. One problem for neutrino-source searches comes from the use of historically-driven class definitions of AGN, which are based on specific spectral properties that are not necessarily optimal for the selection of potential neutrino sources.

This talk will motivate a study that aims to address this problem in two stages. The first stage will use multi-wavelength data to define a source selection using modern machine-learning approaches in a way that emphasizes intrinsic physical properties and mostly disregards the general AGN classification. This will allow to identify potential neutrino sources similar in physical properties to those associated with the currently detected "hot spots". The second part will perform a statistical analysis in the form of a correlation analysis, for example a stacking search, using these previously defined source selections.

T 119.2 Thu 16:05 POT/0112

**Searching for neutrino point-sources in the northern hemisphere with IceCube: recent results and outlook** — •Elena Manao, Chiara Bellenghi, Martin Ha Minh, Tomas Kontrimas, and Martin Wolf for the IceCube-Collaboration — Technische Universität München

The IceCube Neutrino Observatory is a one cubic kilometer neutrino telescope deployed deep in the Antarctic ice at the South Pole. One of its main goals is to identify sources of the diffuse astrophysical neutrino flux, discovered by IceCube in 2013. In this talk we present the results of the search for neutrino point-sources in the northern hemisphere, which found evidence of astrophysical neutrino emission from the active galaxy NGC 1068 with a global significance of $4.2\sigma$, and the prospects of an extension of this analysis with several additional years of data.

T 119.3 Thu 16:20 POT/0112

**Solving the multi-messenger puzzle of the AGN-starburst composite galaxy NGC 1068 $^*$** — Bjoern Eichmann[1,2], Foteini Oikonomou[2], •Silvia Salvatore[1], Ralf Juergen Dettmar[1], and Julia Becker Tjus[1] — [1]Theoretical Physics IV, Ruhr University Bochum, Bochum, Germany — [2]Institutt for fysikk, Norwegian University for Science and Technology (NTNU), Trondheim, Norway

Multi-wavelength observations indicate that some starburst galaxies show a dominant non-thermal contribution from their central region. These active galactic nuclei (AGN)-starburst composites are of special interest, as both phenomena on their own are potential sources of highly-energetic cosmic rays and associated gamma-ray and neutrino emission. In our work, a homogeneous, steady-state two-zone multi-messenger model of the non-thermal emission from the AGN corona as well as the circumnuclear starburst region is developed and subsequently applied to the case of NGC 1068, which has recently shown some first indications of high-energy neutrino emission. We show that the entire spectrum of multi-messenger data - from radio to gamma-rays including the neutrino constraint - can be described very well if both, starburst and AGN corona, are taken into account. Using only a single emission region is not sufficient.

Supported by DFG (SFB|,1491)

T 119.4 Thu 16:35 POT/0112

**Estimate of Galactic Neutrino emission** — •Mohadeseh Ozlati Moghadam[1], Kathrin Egberts[1], Constantin Steppa[1], Rowan Batzofin[1], and Elisa Bernardini[2] — [1]University of Potsdam, Potsdam, Germany — [2]University of Padova, Padova, Italy

The origin of high-energy cosmic rays is an enduring mystery in science. As cosmic rays propagate through the universe, they interact with the environment, which eventually produces high-energy neutrinos as well as gamma rays.

High-energy Neutrinos are an unambiguous signal of hadronic interaction and, thus, provide valuable information about particle acceleration mechanisms and the origin of cosmic rays. On the other hand, identifying neutrino sources is a longstanding challenge. Exploiting the simultaneous production of neutrinos and gamma rays, neutrino sources are typically identified based on the tempo-spatial coincidence of variable emission of point-like objects. This has resulted in the detection of TXS 0506+056 as one extragalactic source for Neutrinos.

However, from VHE gamma-ray observation, we know there is a population of Galactic sources, some of which are expected to produce neutrinos as well. In this contribution, we use simulations of the*Galactic*population of*steady*VHE gamma-ray sources to estimate the Galactic neutrino flux. For this, a parametrization of the neutrino production for a given gamma-ray signal is used. We will present a galactic map of expected neutrino fluxes and will make a comparison with data.

T 119.5 Thu 16:50 POT/0112

**Integration of the KM3NeT instrument response function with gammapy software** — •Mikhail Smirnov for the ANTARES-KM3NET-ERLANGEN-Collaboration — Friedrich-Alexander-Universitat Erlangen-Nurnberg (FAU), Erlangen Centre for Astroparticle Physics, Erwin-Rommel-Straße 1, 91058 Erlangen, Germany

The instrument response function (IRF) contains all the necessary information about the physical properties of a neutrino telescope. It is an ideal tool for quick estimation of the sensitivity of the detector to an incoming neutrino flux from distant sources. Since a similar approach is used in gamma ray astronomy, both communities can benefit from using the same software tools and standards. Nowadays the gammapy python package is a standard tool used in the gamma ray community. Synergy between the KM3NeT IRF and gammapy will allow us to use the power of this package and at the same time to push forward the developments of combined analyses in the context of open science. In gammapy, the IRF consists of four main data domains and it is a part of the DL3 format along with the event list. In order to make KM3NeT data compatible with gammapy, the km3irf python package is being developed. This contribution covers in detail the km3irf package and the compatibility of the km3net data with gammapy.