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Constraining the contribution of Seyfert galaxies to the astrophysical diffuse neutrino flux using source population simulations

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Recently, the IceCube collaboration reported evidence for TeV neutrino emission from several nearby Seyfert galaxies that are intrinsically bright in X-rays, with the highest significance found for NGC 1068. The fact that no gamma rays in the TeV energy range are observed from NGC 1068 indicates that these neutrinos are likely to be produced in the AGN corona, which is opaque to high-energy gamma rays. Based on this assumption, we model the neutrino emission of Seyfert galaxies with different X-ray properties. We fit the resulting spectrum for NGC 1068 to public IceCube data and find that our model provides a good fit to the data. Using the result of this fit as a benchmark, we apply our model to a selection of nearby Seyfert galaxies and a simulated population of sources. Taking into account the uncertainties in the cosmological evolution of Seyfert galaxies, this allows us to derive constraints on both the contribution of these sources to the astrophysical diffuse neutrino flux and the underlying source modelling parameters. In particular, we explore a possible correlation between the intrinsic X-ray luminosity of a source and its neutrino emission. Connecting the knowledge of individual nearby Seyfert galaxies to the source population as a whole, this approach provides a realistic picture of the contribution of Seyfert galaxies to astrophysical neutrino observations.

Primary author: SAURENHAUS, Lena (Max Planck Institute for Physics)

Co-authors: CAPEL, Francesca (Max Planck Institute for Physics); OIKONOMOU, Foteini (NTNU Trondheim)

Presenter: SAURENHAUS, Lena (Max Planck Institute for Physics)

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