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Modeling a large AGN sample to unveil the signatures of neutrino emission

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Active galactic nuclei (AGN) are one of the most promising classes of extragalactic cosmic-ray accelerators. This has been recently strengthened by increasing indications that AGN, and in particular blazars, may be sources of IceCube neutrinos. In this talk I report on recent results from self-consistent leptohadronic modeling of a large sample of blazar AGN, where the observed multi-wavelength spectrum is described by means of a self-consistent numerical radiation model of cosmic-ray interactions. First, I will discuss recent results from the modeling of a sample of 324 gamma-ray-bright blazars, most of which are flat-spectrum radio quasars (FSRQs). I show that for about one-third of the blazars in the sample, cascades from hadronic interactions can help explain observations in the X-ray band, in agreement with recent results on individual IceCube candidates. By extrapolating from these results, we can also predict the diffuse neutrino flux from the entire blazar population, which I show is at the level of 20% of the diffuse flux observed by IceCube. Finally, I present ongoing efforts to model a sample of 30 high-synchrotron-peaked BL Lacs (HBLs) associated with high-energy IceCube alerts. I discuss the implications of these results for the next generation of neutrino experiments, like IceCube-Gen2.

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