Contribution ID: **285** Type: **Oral Presentation**

Neutrino Emission from Bright Blazar Flares

Wednesday 9 July 2025 14:40 (20 minutes)

Blazars, a subclass of active galactic nuclei, have emerged as candidates for the sources of very-high-energy astrophysical neutrinos observed by the IceCube Neutrino Observatory. Notable temporal and spatial coincidences, particularly the event IceCube-170922A coinciding with a flare from TXS 0506+056, have sparked interest in the connection between these objects and neutrino production. In this study, we utilize the time-dependent lepto-hadronic code OneHaLe to fit the spectral energy distributions and light curves of bright gamma-ray flares from a sample of blazars detected by Fermi-LAT. In comparison to the calorimetric estimates of neutrino detection rates provided by Kreter et al. (2020), we model the flares with variations in proton injection spectra, allowing for a full assessment of neutrino production. Our findings reveal an overestimation in neutrino production rates using the calorimetric approach, typically by a factor of approximately 10, in cases where gamma-ray emissions are dominated by proton-synchrotron radiation. We also show that the non-detection of neutrinos during these flares does not necessarily imply a lack of relativistic protons within the jet, and shows that future-generation observatories may be able to detect the presence of said protons.
The work to be presented has been published in *Robinson & Böttcher* 2024 ApJ 977 42 (DOI 10.3847/1538-4357/ad8dce).

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Session Classification: Astrophysics & Space Science

Track Classification: Track D1 - Astrophysics