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A Two-zone Blazar Radiation Model for "Orphan" Neutrino Flares

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In this work, we investigate the 2014–2015 neutrino flare associated with the blazar TXS 0506+056 and a recently discovered muon neutrino event IceCube-200107A in spatial coincidence with the blazar 4FGL J0955.1+3551, under the framework of a two-zone radiation model of blazars where an inner/outer blob close to/far from the supermassive black hole is invoked. An interesting feature that the two sources have in common is that no evidence of GeV gamma-ray activity is found during the neutrino detection period, probably implying a large opacity for GeV gamma rays in the neutrino production region. In our model, continuous particle acceleration/injection takes place in the inner blob at the jet base, where the hot X-ray corona of the supermassive black hole provides target photon fields for efficient neutrino production and strong GeV gamma-ray absorption. We show that this model can self-consistently interpret the neutrino emission from both blazars in a large parameter space. In the meantime, the dissipation processes in outer blob are responsible for the simultaneous multiwavelength emission of both sources. In agreement with previous studies of TXS 0506+056, an intense MeV emission from the induced electromagnetic cascade in the inner blob is robustly expected to accompany the neutrino flare in our model and could be used to test the model using the next-generation MeV gamma-ray detector in the future.

other Collaboration

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Theoretical Results

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