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Delayed Radio Flares in Blazars Associated with High Energy Neutrinos from Expanding Leptohadronic Plasma Blobs

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Blazars are a subclass of Active Galactic Nuclei (AGN) powered by the accretion of matter to a supermassive black hole (SMBH). Charged particles can be accelerated in the jets produced near the SMBH and produce non-thermal radiation relativistically boosted in the observer's frame. Recently a high-energy neutrino has been detected from the direction of a distant blazar known as TXS 0506+056, simultaneously with a flux enhancement in the gamma-rays, indicating the presence of a hadronic population in the jet. Intriguingly, no radio flare accompanied the neutrino event. However, two years later, the radio flux increased significantly, suggesting that the jet was initially radio-opaque and that the radio and high-energy emission regions lie at different scales along the outflow. This pattern of delayed radio flares relative to high-energy outbursts also appears in other blazars associated with high-energy neutrino emission. Motivated by these observations, we investigate whether an expanding emitting region, containing a leptohadronic particle population and propagating along the jet, can reproduce the spectral features for the case of TXS 0506+056 and the observed time lag between radio and high-energy signals.

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