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A Neutral Beam Model for High-energy Neutrino Emission from the Blazar TXS 0506+056 B. THEODORE ZHANG, Pennsylvania State University, MARIA PETROPOULOU, University of Athens, Greece, KOHTA MURASE, Pennsylvania State University, FOTEINI OIKONOMOU, Norwegian University of Science and Technology — The IceCube collaboration reported a $\sim 3.5\sigma$ excess of neutrino events in the direction of the blazar during a $\sim$6 month period in 2014–2015, as well as the ($\sim 3\sigma$) detection of a high-energy muon neutrino during an electromagnetic flare in 2017. We explore the possibility that the 2014–2015 neutrino excess and the 2017 multi-messenger flare are both explained in a common physical framework that relies on the emergence of a relativistic neutral beam in the blazar jet due to interactions of accelerated cosmic rays (CRs) with photons. We demonstrate that the neutral beam model provides an explanation for the 2014–2015 neutrino excess without violating X-ray and γ-ray constraints, and also yields results consistent with the detection of one high-energy neutrino during the 2017 flare. If both neutrino associations with TXS 05065+056 are real, our model requires that (i) the composition of accelerated CRs is light, with a ratio of helium nuclei to protons 5, (ii) a luminous external photon field ($\sim 10^{46}$ erg s^{-1}) variable (on year-long timescales) is present, and (iii) the CR injection luminosity as well as the properties of the dissipation region (i.e., Lorentz factor, magnetic field, and size) vary on year-long timescales.

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