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High-Energy Neutrinos from Non-Relativistic Shock-Powered Transients

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Shock interaction has been argued to play a role in powering a range of optical transients, including supernovae, classical novae, stellar mergers, tidal disruption events, and fast blue optical transients. These same shocks can accelerate relativistic ions, generating high-energy neutrino and gamma-ray emission via hadronic pion production. We introduce a model for connecting the radiated optical fluence of non-relativistic transients to their maximal neutrino and gamma-ray fluence. We apply this technique to a wide range of extragalactic transient classes in order to place limits on their contributions to the cosmological high-energy neutrino backgrounds. Based on a simple model for diffusive shock acceleration at radiative shocks, calibrated to novae, we demonstrate that several of the most luminous transients can accelerate protons up to 10^{16} eV, sufficient to contribute to the IceCube astrophysical background. Furthermore, we show that several of the considered sources–particularly hydrogen-poor supernovae–may serve as "gamma-ray- hidden"neutrino sources due to the high gamma-ray opacity of their ejecta, evading constraints imposed by the non-blazar Fermi-LAT background.

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