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Photodisintegrated gamma rays and neutrinos from heavy nuclei in the gamma-ray burst jet of GRB 130427A

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Detection of ˜ 0.1-70 GeV prompt gamma-ray emission from the exceptionally bright gamma-ray burst (GRB) 130427A by the Fermi-Large Area Telescope provides an opportunity to explore the physical processes of GeV gamma-ray emission from the GRB jets. In this work we discuss interactions of Iron and Oxygen nuclei with observed keV-MeV photons in the jet of GRB 130427A in order to explain an additional, hard spectral component observed during 11.5-33 second after trigger. The photodisintegration time scale for Iron nuclei is comparable to or shorter than this duration. We find that gamma rays resulting from the Iron nuclei disintegration can account for the hard power-law component of the spectra in the 1-70 GeV range, before the gamma-gamma to electron-positron pair production with low-energy photons severely attenuates emission of higher energy photons. Electron antineutrinos from the secondary neutron decay, on the other hand, can be emitted with energies up to 2 TeV. The flux of these neutrinos is low and consistent with non-detection of GRB 130427A by the IceCube Neutrino Observatory.

Summary

Understanding the production mechanism of GeV prompt gamma ray emission from GRB 130427A.

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