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Identifying potential Binary Neutron Star merger events from the Fermi GBM Gamma-Ray Burst Catalog

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The detection of GRB 170817A, coincident with the gravitational wave signal GW170817 from a binary neutron star (BNS) merger, confirmed the link between short gamma-ray bursts (sGRBs) and compact object mergers. I will present a study focused on the identification of potential sGRBs associated with BNS mergers by analyzing the Fermi GBM Burst Catalog using an unsupervised machine learning approach.

The results reveal a distinct cluster of merger-like GRB events, including GRB 170817A and GRB 150101B, and other kilonova-associated events. Validation of the method was performed using multiple dimensionality reduction techniques—PCA, t-SNE, and UMAP—along with comparisons to kilonova candidates from other studies, confirming the robustness of the approach. Furthermore a pipeline has been developed to identify host galaxies for potentially nearby off-axis GRB events. In this way we can optimize the identification and follow-up observations for kilonovae detected through their associated off-axis sGRBs.

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