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Optically Thin Inverse Compton Scattering in the Prompt Emission of Gamma Ray Bursts

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Abstract

The mechanism behind the non-thermal emission from the prompt emission of Gamma Ray Bursts is still unknown. Despite many collaborative efforts to understand the prompt emission a single radiation model cannot explain this emission because of the unique nature of each burst. We investigated the possibility of optically thin inverse Compton scattering as the radiation mechanism responsible for the observed gamma-ray photons in the prompt emission of Gamma Ray Bursts by empirical modelling and then confirming it through direct physical modelling of the observed data. From the sample of 40 GRB, we found evidence of such process in GRB200829582 and GRB200412381 where we found a significant blackbody component throughout the burst, whereas GRB230614424 has Band as the best fit function throughout the burst. The empirical modelling is given a physical interpretation and then compared with direct physical modelling. The outflow parameters of the relativistic jet, and physical parameters of inverse Compton scattering for GRB200829582 and GRB200412381 are calculated which shows that the photosphere lie well above the saturation radius and thus the thermal component observed is emitted from the photosphere. At last it was found that majority of electrons in the dissipation site turns out to be mildly relativistic and only a fraction of them are in the power law part of the electron distribution.