

# Probing episodes of phenomena associated with naturally produced GRB using X-ray free electron lasers

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Gamma-ray bursts (GRB) are the most energetic explosions that occur naturally in distant galaxies [1]. Their analysis facilitates the probing of early Universe and its expansion, the understanding of stellar evolution, the analysis of high energy phenomena and of the matter under extreme conditions [2, 3, 4]. GRBs constitute excellent natural laboratory settings to test the fundamental physics theories the properties of matter at data on matter-radiation interaction. This analysis enabled by the data acquisition Earth orbiting satellites may be complemented by experiments that can be conducted in a controlled manner in laboratories. The constant improvement of the X-ray free electron lasers facilities [5, 6] allow the realization of highly integrated projects [7, 8]. Experiments that would mimic the conditions in the outer galactic region and that can be conducted are: i) study of matter at extreme conditions, ii) analysis of matter dynamics at the atomic and molecular level employing pump-probe experiments on pulsed molecular supersonic beams, iii) study of electronic structure of matter under high magnetic fields, and iv) study the DNA mutations to test the hypothesis that GRB associated radiation with optimal intensities at the sea level could lead to bio-diversification [9].

**Primary author:** Dr UKA, Arban (Epoka University)

**Co-author:** RUFFINI, Remo (ICRANet, ICRA, INAF)

**Presenter:** Dr UKA, Arban (Epoka University)

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