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The Fermi high-energy view of GRB 221009A, the ”brightest of all time” or B.O.A.T. GRB

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In October 2022, an extremly powerful and rare Gamma-Ray Burst, GRB 221009A, was observed by tens of space- and ground-based observatories, including both instruments onboard the Fermi Mission, the Large Area Telescope (LAT) and the Gamma-Ray Burst Monitor (GBM). The triggering pulse, detected by Fermi-GBM, was followed by a prompt phase lasting a few hundred seconds, and by an extended emission which was detected by Fermi-LAT for over two days.
Here we present the highlights from the LAT analysis of this exceptional event.
The high-energy (>10 MeV) emission was measured by the LAT in the triggering pulse one second before the associated low-energy component detected by GBM. During the burst prompt phase, the extreme intensity of the burst in hard X-rays compromised the LAT data quality, resulting in the definition of Bad Time Interval (BTI) for a total of 63 seconds. The LAT late time emission shows a power law decay, but its extrapolation based on the first 450 seconds suggests that the afterglow started during the prompt emission. Furthermore, we found that the high-energy events detected by the LAT cannot have a Synchrotron origin but, during the prompt emission, they are probably associated with an additional Self Synchrotron Compton (SSC) component. Late time high-energy events are instead harder to explain as products of SSC or TeV electromagnetic cascades, which raises questions regarding their origin. Overall, GRB221009A, stands out compared to other Fermi-LAT GRBs, indicating that it is an exceptionally rare event.

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