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Observation of a second spectral component in GRB 221009A

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The occurrence of long-duration gamma-ray bursts (GRBs) is linked to ultra-relativistic jets formed soon after the collapse of massive stars. Initially, a highly variable radiation in the MeV range is detected, lasting for a few minutes, which is a result of internal dissipation within the jet. This is followed by afterglow radiation lasting for even several days, originating from non-thermal electrons in the medium accelerated by the relativistic blast wave. The observed afterglow emissions in radio frequencies to TeV energies are commonly explained by the mechanisms of synchrotron and synchrotron self-Compton radiation. However, because of the lack of sensitivity in MeV-GeV observations, the distinct identification of the TeV spectral component for GRBs detected in the high-energy gamma-rays (HE) has been challenging. In this presentation, I aim to highlight the unique GeV-TeV spectral component of GRB 221009A observed during the initial 30 minutes. The modeling of the data comprising LAT in the initial time bins and AGILE in the late time for the GeV regime, along with the TeV data from LHAASO, provides constraints on the magnetic field and the energy of the electrons accelerated in the relativistic shock. Furthermore, we demonstrate that intense initial MeV radiation impacts early TeV afterglow radiation through external Compton cooling of electrons.

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