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Snapshot Observations and Time-resolved Modeling of Gamma-ray Blazars during Major Flares

Major blazar flares likely result from injections of relativistic pair plasma into the inner jets. Quantifying the jet's basic physical parameters has been hampered by
the modest sensitivity of past observations, which has allowed only time-averaged pictures of these rapidly changing phenomena. The capabilities of gamma-ray observatories have dramatically improved recently with H.E.S.S. and MAGIC, and the improvements continue in 2007 with the advent of VERITAS and the Large Area Telescope (LAT, 30 MeV < E < 300 GeV) aboard GLAST. These instruments can measure the spectra of flaring blazars on time scales of hours or less, shorter than the expected cooling time scales of the pair population. Using a sophisticated code based on the work of M. Boettcher and extended by us, we explore the effects of various cooling mechanisms and jet physical conditions on the SED "snapshots" that are possible with joint LAT/TeV observations. The code includes cooling via synchrotron, synchrotron self-Compton, and external Compton radiation, allows for finite jet injection times, and evolves the pair population self-consistently as it cools after a major flare. We demonstrate the power of such snapshot observations in constraining the jet physics and the importance of adequate modeling to interpret the observations.

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