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Temporal Evolution of Prompt GRB Polarization

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The dominant radiation mechanism that produces the prompt emission in gamma-ray bursts (GRBs) remains a major open question. Spectral information alone has proven insufficient in elucidating its nature. Time-resolved linear polarization has the potential to distinguish between popular emission mechanisms, e.g. synchrotron radiation from electrons with a power-law energy distribution or inverse Compton scattering of soft seed thermal photons, which can yield the typical GRB spectrum but produce different levels of polarization. Furthermore, it can be used to learn about the outflow's composition (i.e. whether it is kinetic-energy-dominated or Poynting-flux-dominated) and angular structure. For synchrotron emission, it is a powerful probe of the magnetic field geometry. In this talk, I will discuss synchrotron emission from a thin ultra-relativistic outflow and use a phenomenological pulse model to construct the energy-dependent temporal evolution of polarization for both coasting and accelerating flows. I will present results for a top-hat jet with sharp and smooth edges with observers having different viewing angles. I will then use the single pulse model to construct the polarization evolution for multiple overlapping pulses that arise due to episodic internal dissipation in the outflow. In the end, I will discuss how energy dependent polarization can be used to distinguish between different particle acceleration/heating scenarios in a magnetized outflow.

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