Space Science Seminar
Tuesday, 2020 June 16
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UAH Zoom

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Photospheric Polarization Signatures of Long Gamma Ray Bursts

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Host: Dr. Michelle Hui

A comprehensive understanding of Gamma Ray Bursts (GRBs) has been elusive due to the variety of questions surrounding the radiation mechanism at play in these events. Polarization measurements of GRBs can heavily constrain the relevant radiation mechanisms and the structure of the GRB jet; however, there is a limited number of theoretical predictions that observed GRB polarizations can be compared against. Here, we conduct radiative transfer calculations of a set of two dimensional relativistic hydrodynamic long GRB (LGRB) jet simulations, of a constant and a variable jet, using the Monte Carlo Radiation Transport (MCRaT) code. MCRaT has been enhanced by the inclusion of polarization; it has been first verified by reproducing a variety of results in the literature and then used to obtain the time integrated and resolved polarization degrees and angles of the synthetic LGRBs. While the obtained time-integrated polarization degrees are consistent with the constraints from the POLAR experiment, they are lower than other theoretical studies due to the lack of strong gradients in the model jet profiles that we use. The time resolved results suggests that GRBs with wide jets observed on axis will have small polarization degrees and constant polarization angles, during the brightest portion of the light curve. GRBs observed off axis will have larger polarization degrees and polarization angles that change with the temporal structure of radiating shells in the outflow. We then place our results in the context of GRB prompt emission models and future LEAP and POLAR-2 GRB polarimetry detections.

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