



Contribution ID: 36

Type: not specified

ALMA Detection of a Linearly Polarised Reverse Shock in GRB 190114C

Tuesday, October 15, 2019 9:40 AM (15 minutes)

Contributed talk

Abstract:

“We present the earliest observation and first detection of polarized millimeter emission in a γ -ray burst with ALMA Cycle 7 Band 3 (97.5 GHz) observations of GRB 190114C. With observations spanning 2.2 to 5.2 hours after the burst, we detect linear polarization in the GRB afterglow at $\sim 5\sigma$, decreasing from $\Pi=(0.87\pm 0.13)\%$ to $(0.60\pm 0.19)\%$, and evolving in polarization position angle from (10 ± 5) degrees to (-44 ± 12) degrees. We show that the optical and X-ray observations between 0.03 days and ~ 0.3 days are consistent with a fast cooling forward shock expanding into a wind environment. However, the optical observations at ≈ 0.03 days, as well as the radio and millimeter observations arise from a separate component, which we interpret as emission from the reverse-shocked jet. Using the measured linear polarization, we constrain the coherence scale of tangled magnetic fields in the GRB jet to an angular size of $\theta \approx 0.001$ radian, while the rotation of the polarization angle rules out the presence of large scale, ordered axisymmetric magnetic fields, and in particular the popular toroidal magnetic field model for GRBs outflows. “

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Session Classification: ISM, SF