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Qiang Chen - Numerical study of magnetized GRB afterglow shocks: dynamics and radiation emission

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The observation of GRB afterglow is an important means to locate the central emission counterpart and limit the physical parameters. We proposed a generic forward and reverse shock model to study the magnetization of the ejecta. The model is based on total energy conservation of each region in the whole shock system, hence can efficiently describe the dynamics evolution with an overall scope, and is found governed by the magnetic field corrected shock jump conditions. Principally the new model can deal with arbitrarily magnetization degree, however with high degrees the reverse shock is suppressed even if it actually exists. We explored both ISM and wind type circum-burst medium. The light curve of wind type is flatter and more luminous by nearly an order compared to the ISM type. The synchrotron radiation light curves of both ISM and wind profile show the peak flux emission occurs when $\sigma \sim 0.1 - 1$. The numerical dynamics results helped in the interpretation of this perplexed trend. In a case of high σ, the magnetized plasma is radiatively inefficient, hence if the magnetic power is limited by total energy which is typically $\sim 10^{52}$ erg, the resulting luminosity must be very low due to the suppression of the ejecta density and the total particle number. This happens while magnetic energy dominates over kinetic energy once $\sigma > 1$.

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