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A two-step energy injection explanation for the rebrightenings of the multi-band afterglow of GRB 081029

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The afterglow of GRB 081029 showed unusual behavior, with a significant rebrightening being observed at optical wavelength at about 3000 s after the burst. One possible explanation is that
the rebrightening is resulted from energy injection. Here, we present a detailed numerical study of the energy injection process and interpret the X-ray and optical afterglow light curves of GRB 081029. In our model, we have assumed two periods of energy injection, each with a constant injection power.
One injection starts at 2.8×10^3 s and lasts for about 2500 s, with a power of 7.0×10^{47} erg s^{-1}. This energy injection is mainly engaged to
account for the rapid rebrightening at about 3000 s. The other injection starts at 8.0×10^3 s and lasts for about 5000 s. The injection power is
3.5×10^{47} erg s^{-1}. This energy injection can help to explain the slight rebrightening at about 10000 s. It is shown that the observed optical afterglow,
especially the marked rebrightening at about 3000 s, can be well reproduced. In X-ray band, the predicted amplitude of the rebrightening is much shallower, which is also consistent with
the observed X-ray afterglow light curve. It is argued that the two periods of energy injection can be produced by the falling of clumpy materials onto the central compact object of the burster,
which leads to an enhancement of accretion and gives birth to a strong outflow temporarily.

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