U03a Search for pair echo signatures in the gamma-ray light curve of GRB190114C

I. Vovk (ICRR, U. Tokyo)

Propagation of very-high-energy gamma rays over cosmological distances inevitably leads to their absorption in interactions with extragalactic photon fields. The absorbed power is transferred to the electromagnetic cascades and eventually re-emitted in a form of the lower-energy γ-ray "pair echo". In the presence of intergalactic magnetic field (IGMF), the "echo" emission is spread in time and angle, reducing the observable signal. Non-detection of such "echo" from several blazars has been used earlier to set a lower limit on the IGMF strength at $z \sim 0.1$. Similar measurements at larger redshifts, required to clarify IGMF origin, are challenging due to strong absorption, reducing the number of detectable persistent γ-ray sources. Several transient γ-ray sources, however – including GRBs, – have been detected from redshifts up to $z \sim 1$, potentially expanding the redshift range of the IGMF measurements. Here a model of the cascade "pair echo" is applied to GRB190114C – the first γ-ray burst contemporaneously detected in high- and very-high-energy γ-ray bands. It is shown that the internal spread of the cascade in the absence of IGMF dilutes the "echo" signal over 1-100 kiloseconds depending on the energy. The model prediction is found to agree with the detected lower-energy γ-ray emission 10 kiloseconds after the burst, though the "echo" signal remains indistinguishable from the intrinsic γ-ray burst afterglow flux within the measurement uncertainties. Implications of these findings in the context of IGMF measurement are discussed.