

Insights from modelling the brightest Fermi-LAT blazar flare

The electromagnetic flare of the flat-spectrum radio quasar (FSRQ) 3C 454.3 in November 2010 was the brightest γ -ray flare ever observed by the *Fermi*-LAT from a blazar. We performed the data analysis of the multiwavelength (from infrared photons to γ rays) quasi-simultaneous 1-day-averaged spectral-energy distributions (SEDs) for seven days of the flare and modelled the observed emission with the AM³ program for the time-dependent simulation of radiative processes. We show that each of the 1-day averaged SEDs can be well described with a leptonic model producing the observable emission originating from a $\sim 10^{16}$ -cm-sized region located beyond the outer radius of the broad-line region (BLR). The emission region (blob) should be a stationary feature in the jet into which the relativistic plasma with a high bulk Lorentz factor ($\Gamma \sim 20 - 40$) is injected. On the contrary, modelling the blob as moving along with the bulk motion of the jet plasma results in an underprediction of the γ -ray flux due to the lack of target photons for the inverse Compton process in the later days of the flare. We demonstrate that the γ -ray data support that the observed emission comes from the electrons with a rather low maximum injection energy $E_e^{\text{max}} \sim 10^9$ eV implying small acceleration efficiency. Assuming protons might be accelerated along with electrons with the same efficiency, we obtain the constraints on the neutrino yield from 3C 454.3.

Affiliation

Department of Physics, Norwegian University of Science and Technology (NTNU)

Auteur principal: PODLESNYI, Egor (NTNU)

Co-auteur: Prof. OIKONOMOU, Foteini (NTNU)