GAMMA-RAYS FROM COLLISIONS OF STARS WITH RELATIVISTIC BLOBS IN JETS OF AGNs

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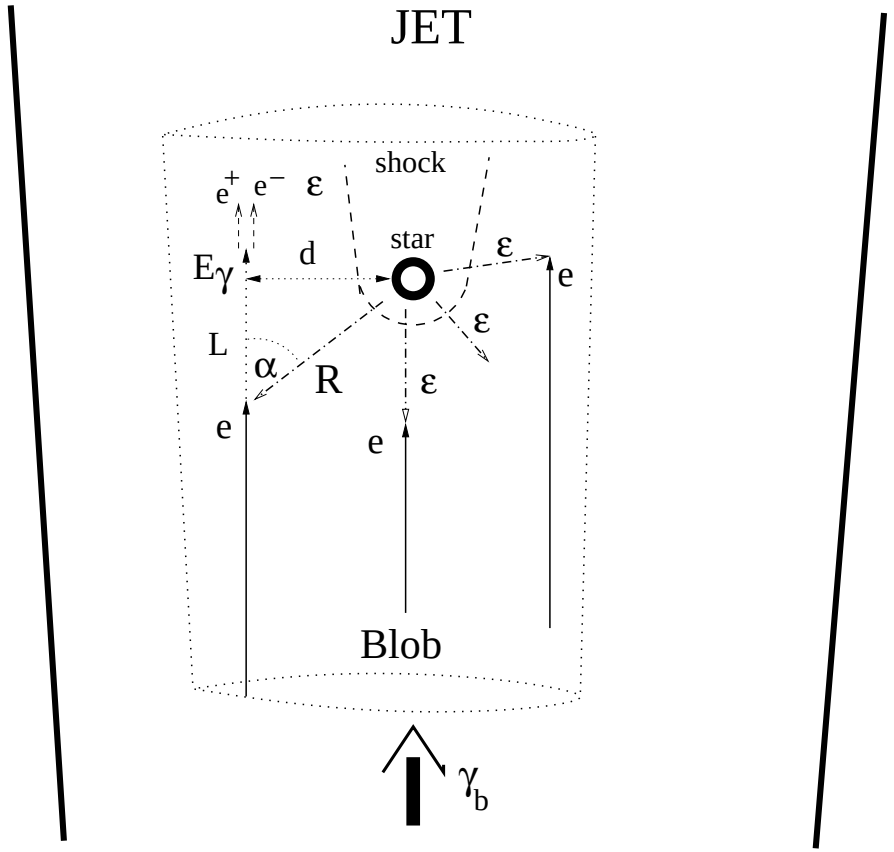
A star colliding with the blob in jet of AGN



- Relativistic electrons in the blob, moving with the Lorentz factor $\gamma_{\rm b}$, suffer strong energy losses on comptonization of radiation coming from a single star.
- Electrons are injected isotropically into the blob with a power law spectrum to TeV energies.
- Electrons scatter stellar radiation to γ-rays.
- γ-ray photons initiate IC $e^{\pm}$ pair cascade.
- γ-ray spectrum from IC $e^{\pm}$ pair cascade is calculated.

Gamma-ray spectra from star-blob incounter

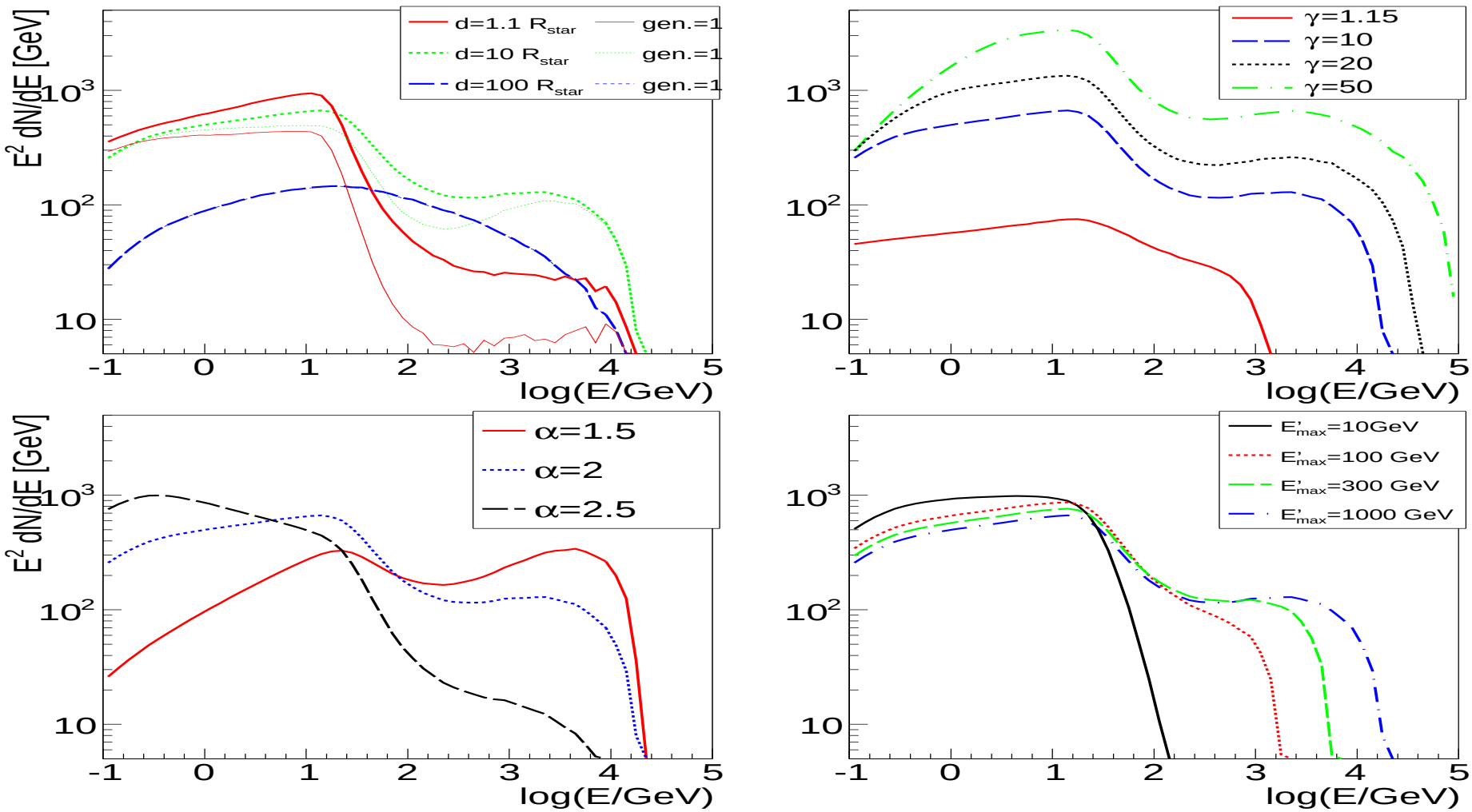


Figure 1: SED of the γ-ray spectrum for a power law differential spectrum of electrons with an spectral index of α between 0.1 GeV and $E'_{\rm max}$ for fixed impact distance of electrons. Top left panel: dependence on impact distance d, thick lines show the spectra from the full cascade, thin lines the spectra escaping from the first generation of photons. Top right panel: dependence on the Lorentz factor of the blob γ_b. Bottom left panel: dependence on the spectral index of electrons α. Bottom right panel: dependence on the maximum energy of the electrons (measured in the blob's frame): $E'_{\rm max}$. Unless specified otherwise $\gamma_b = 10$, $d = 10\,R_\star$, $\alpha = 2$, $E'_{\rm max} = 1\,$TeV. The spectra are normalised to 1 erg of injected electron energy in the blob's frame of reference.

Interpretation of extreme blazar: PKS 1222+21

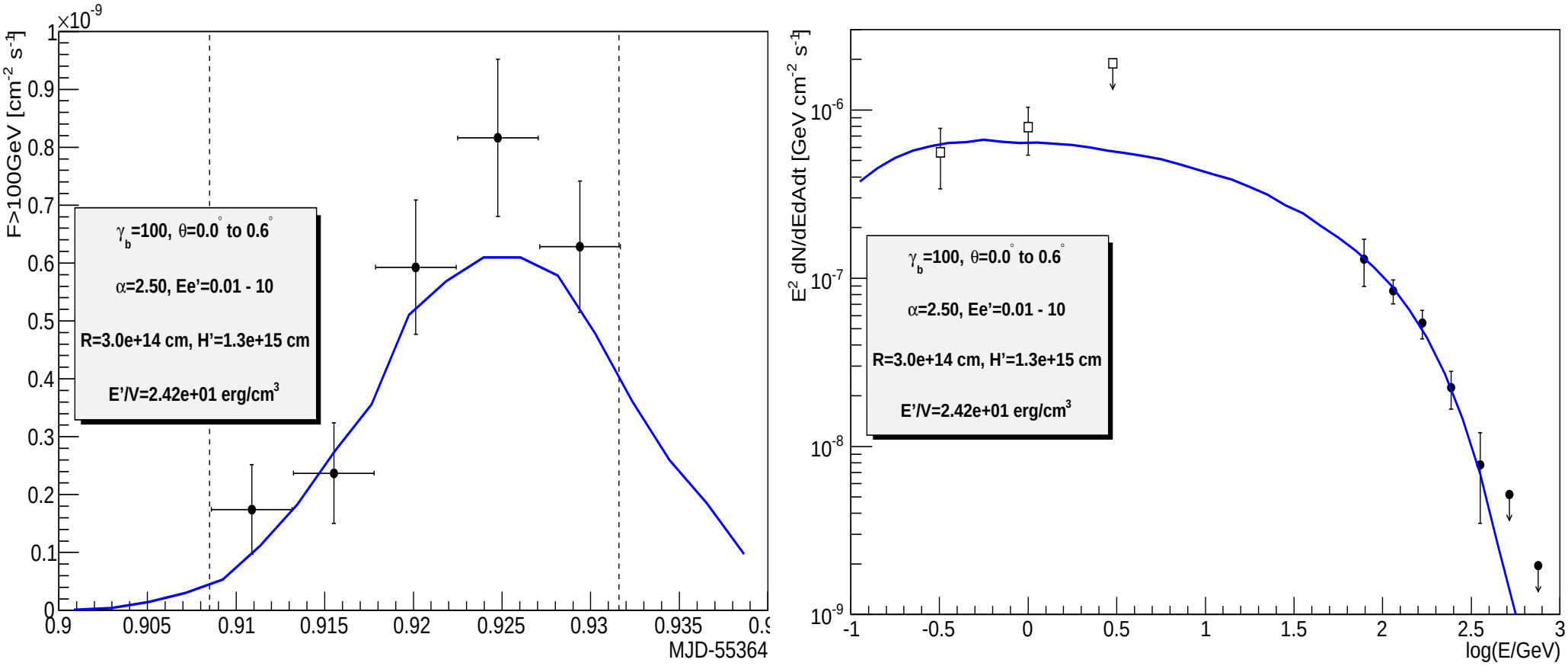


Figure 2: Interpretation of the γ-ray emission (SED) observed during the flare from the FSRQ PKS 1222+21 in June 2010 by *Fermi*-LAT (empty squares) and MAGIC (full circles) is shown on the right figure. A blob has the radius $d = 3 \times 10^{14}\,\mathrm{cm}$ and a Gaussian longitudinal spread with a standard deviation of $H_\mathrm{b} = 1.3 \times 10^{13}\,\mathrm{cm}$ (the reference frame of the observer), and moves with $\gamma_\mathrm{b} = 100$ encountering the O type star ($T_\star = 3 \times 10^4$ K and $R_\star = 10^{12}\,\mathrm{cm}$). The electrons are injected with a power law spectrum (index -2.5 between 10 MeV and 10 GeV, total energy density of $\rho_E = 24\,\mathrm{erg\,cm^{-3}}$ (in the blob's frame of reference). The γ-ray emission is averaged over the observation angle $0 - 1/\gamma_\mathrm{b}$ rad. The absorption in the Extragalactic Background Light is taken into account. The figure on the left shows the light curve during the flare above 100 GeV. The dashed vertical lines are the time range from which the SED is computed.