

## **Theory of photon Comptonization in plasma with velocity shear: an application to structured jets in GRBs**

The spectra of many astronomical objects, in particular GRBs, show a power law shape. Traditionally, this is commonly modeled as due to synchrotron emission from a population of accelerated particles following a power law distribution. However, here we show that multiple scattering of photons in shear layers, as expected in structured jets, naturally produces such a power law. The photons gain their energy by multiple scattering between different regions of different bulk Lorentz factor, thereby gaining their energy from the differential motion of the jet, before escaping inward, into regions of steady (and high) Lorentz factor, where they diffuse until escaping at the photosphere. Thus, this mechanism is an analogue to the well-known Fermi mechanism for particle acceleration. We provide an analytical expression for the obtained power law as a function of the jet structure, thereby showing that the high energy power law observed can be used as a novel tool to study the structure of relativistic jets. We also confirm the analytic predictions of the theory with Monte Carlo simulations that produce power law spectrum from these structured jets.

**Primary author:** VYAS, Mukesh Kumar (Postdoctoral Fellow)

**Co-author:** Prof. PE'ER, Asaf (Bar Ilan University)

**Presenter:** VYAS, Mukesh Kumar (Postdoctoral Fellow)

**Session Classification:** Contributed posters