Anisotropy and polarization effects in blazar emission

Contributed Talk //

Active Galactic Nuclei (AGNs)

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Blazars are radio-loud (RL) active galactic nuclei (AGNs) whose relativistic jets are directed at us. These sources are observed to have spectral energy distributions (SEDs) with two broad-humped components, significant variability throughout the electromagnetic (EM) spectrum, and high average polarization degrees (PDs) from radio to optical energy bands. This study constitutes the first step towards the development of a full angle- and polarization-dependent synchrotron and synchrotron self-Compton (SSC) blazar multi-wavelength emission model with relativistic electrons in a uniform magnetic field.

Using the code developed in this work, we simulate different orientations of the magnetic field w.r.t. the jet axis (such as parallel, perpendicular, and oblique field geometries) that may exist within a blazar jet, as well as different viewing angles relative to the jet axis, and study the impact on the synchrotron and SSC spectra and multi-wavelength polarization. We also report on the impacts of varying the electron power-law index on the synchrotron and SSC emission.

The results of this study demonstrate that, as expected, the synchrotron emission is dramatically affected by variations of both the magnetic field orientation and our line of sight (LoS) w.r.t. the jet axis, whereas the SSC emission is almost independent of them. This is evident, especially in an oblique magnetic field case, where synchrotron emission is substantially suppressed when our LoS and the magnetic field vector are closely aligned. On the other hand, in this field case, SSC emission shows a significant dependence on the magnetic field azimuthal angle. Furthermore, we demonstrate that, as the electron power-law index increases, the SSC emission becomes suppressed, whereas the average PD rises as well.

Keywords: generic blazar; linear polarization; magnetic field orientation; anisotropic synchrotron photon; nonthermal radiative mechanisms ii

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