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Acceleration processes in SSC Models

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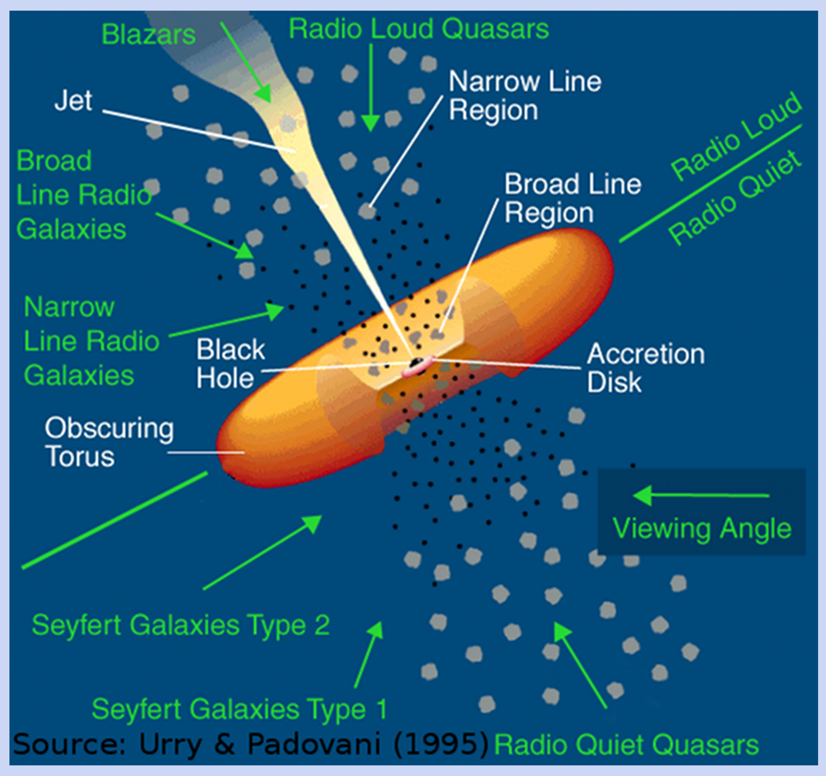
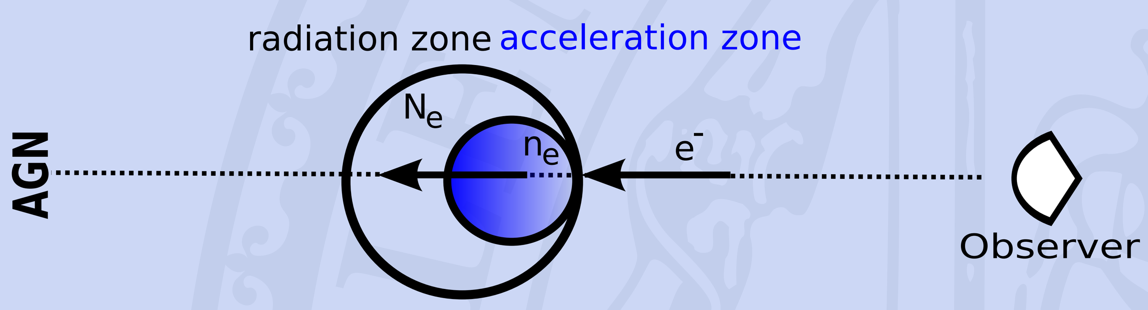
Despite many efforts the emission from jets of active galacitic nuclei and thus the physical processes within a jet are still poorly understood. One successful approach to model the characterisitc double-humped **S**pectral **E**nergy **D**istribution from blazars are **S**ynchrotron-**S**elf-**C**ompton Models where the first peak in the SED is due to the synchrotron emission of e^- in the jet's magnetic field while the second peak arises from the Compton upscattering of these photons by the same e^- distribution. These models are suffering certain drawbacks concerning e.g. the variability in the emission of BL Lac objects or the number of degrees of freedom.
Code **O**n **J**etsystems **O**f **N**on-thermally **E**mitting **S**ources - our timedependent SSC Model considering the relevant acceleration and radiation processes selfconsistently.
Comparison of our model with observations allows insight into the jets microphysics while explaining variability.

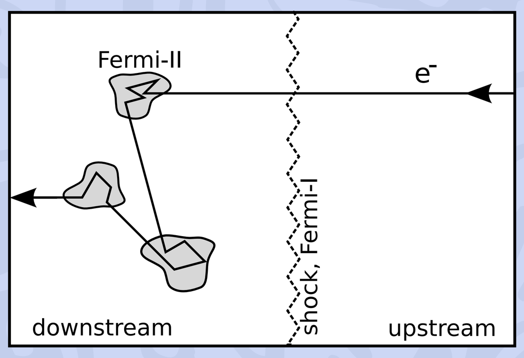


The Model

Spherical volume (blob) moving at Lorentz factor Γ towards the observer containing homogenous & isotropic electron & photon distributions, calculations made in the blob's rest frame:



Upstream e^- enter the acceleration zone and are continuously accelerated via Fermi-I and Fermi-II processes while suffering synchrotron losses.

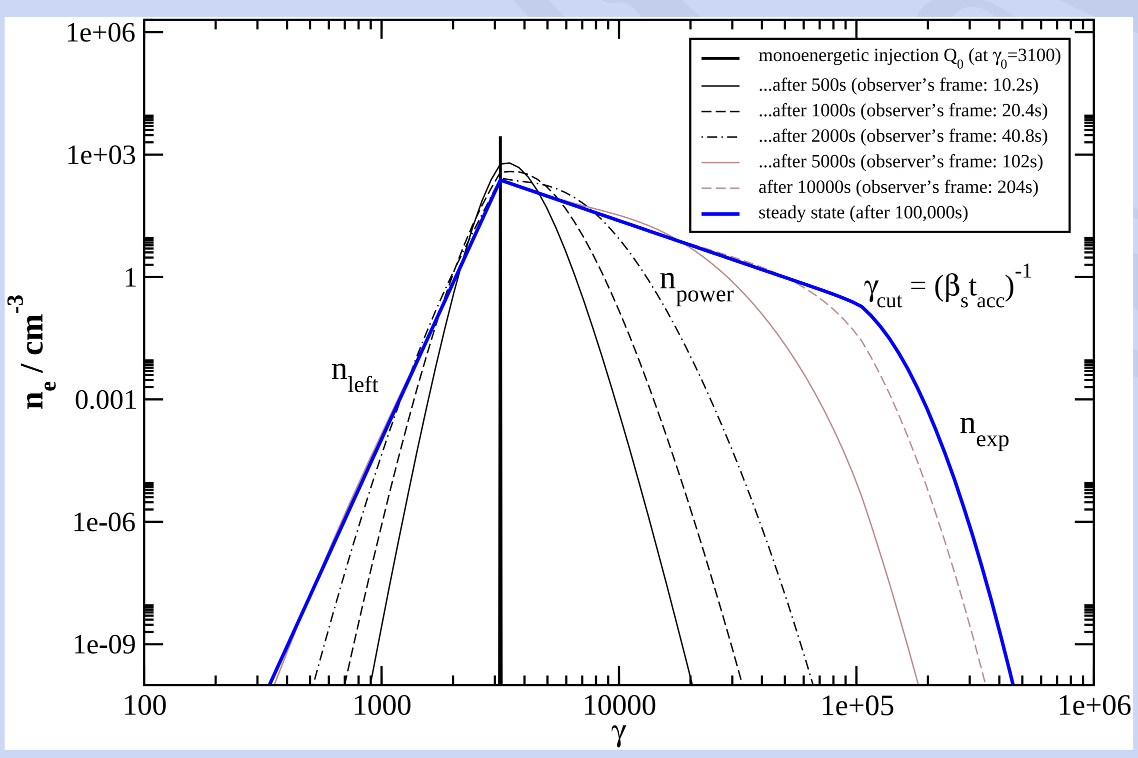


Kinetic equation:

$$\partial_t n_e = \partial_\gamma \left[(\beta_s \gamma^2 - t_{acc}^{-1}\gamma) \cdot n_e \right] + \partial_\gamma \left[[(a+2)t_{acc}]^{-1} \gamma^2 \partial_\gamma n_e \right] + Q_0 - t_{esc}^{-1} n_e$$

- a ratio of Shock- to Alfvén-speed (Fermi-I/Fermi-II)
- after t_{esc} the electrons enter the radiation zone

Acceleration zone

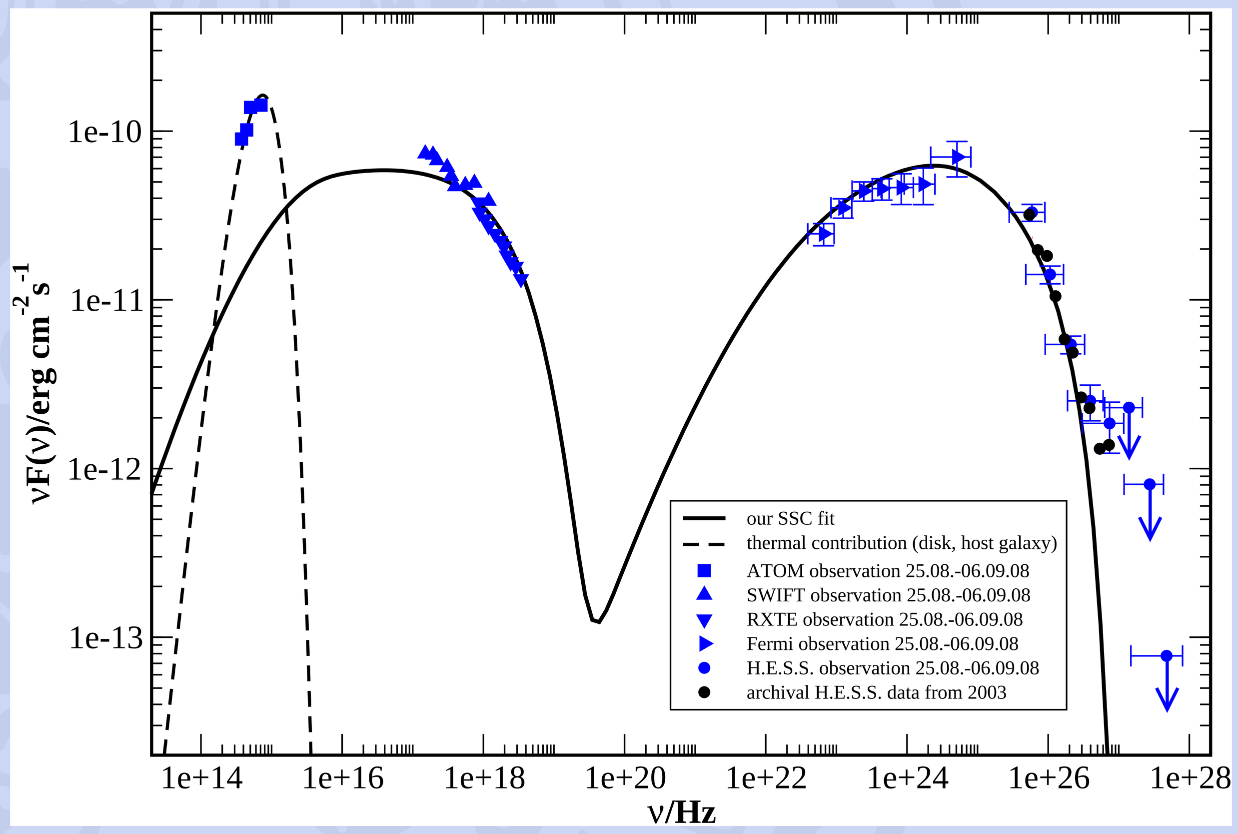


Shape of n_e depends on the competition of acceleration and radiation processes, especially:
- $n_{left} \propto$ Fermi-II processes & synchrotron radiation
- $n_{exp} \propto$ Fermi-II processes, i.e. $\propto a$ and $\propto t_{acc}$
- $n_{power} = a_1 \gamma^\alpha$ where $\alpha \propto t_{acc}/t_{esc}$

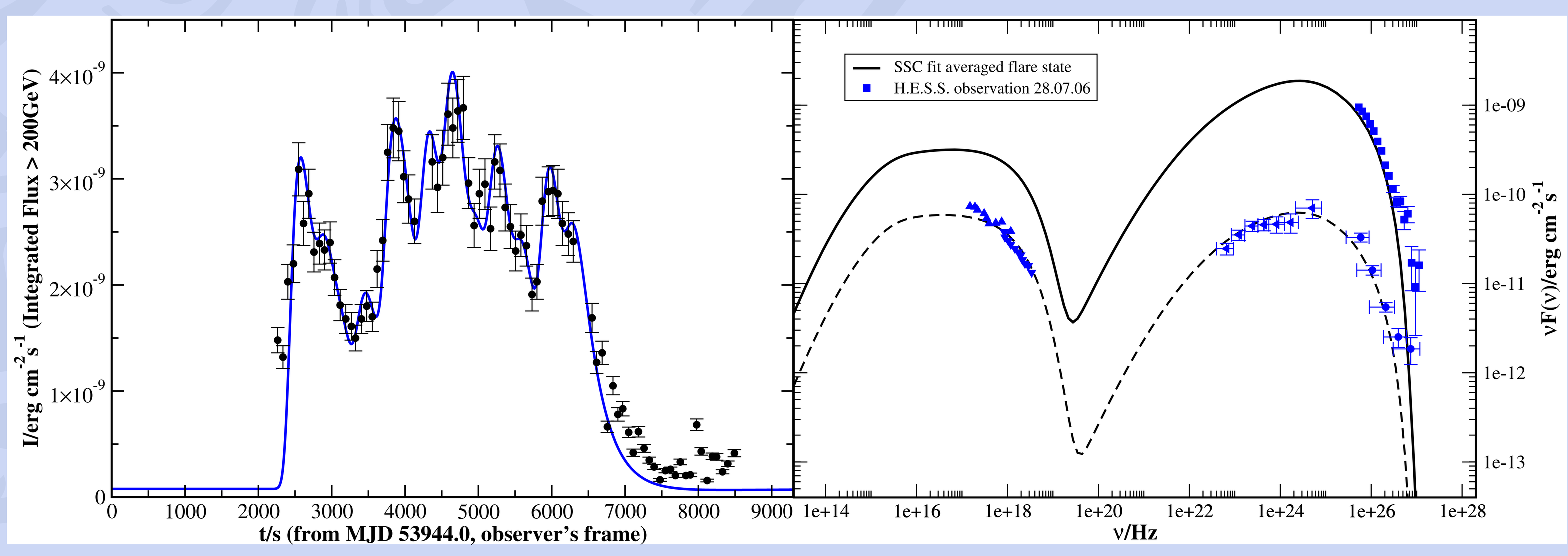
timescale of the dynamics induced by spacial dimesion of the zone $t_{esc} \propto R_{acc}/c$ and t_{acc} where $t_{acc}^{-1} \propto v_{shock}$ and $\propto v_A$.

Application: PKS 2155

All escaping electrons enter the radiation zone where they suffer synchrotron and inverse Compton losses, to calculate the latter the full Klein-Nishina Cross-Section is exploited. Finally the photon distribution is beamed towards the observer to obtain the SED. The injection of mid-energetic electrons into the acceleration zone is able to model the SED of PKS 2155 including the latest Fermi multiwavelength data:



This lowstate can be used to model the VHE flare of PKS 2155 observed by H.E.S.S. in 2006 just by injecting more e^- at γ_0 for certain ammount of times.



Acceleration and radiative cooling then leads to the desired lightcurve. The right figure shows the time averaged high state SED of our model and H.E.S.S.

Conclusions

We developed a successful approach to **explain the variability** of blazars with **no additional parameters** compared to onezone-SSC models the lightcurves can be modelled by modifying the injection function (i.e. inhomogeneities along the jet axis).
The selfconsistency allows a **microphysical interpretation** of many **parameters** used in SSC models.