Influence of the magnetic field on the spectral properties of blazars in the internal shocks scenario

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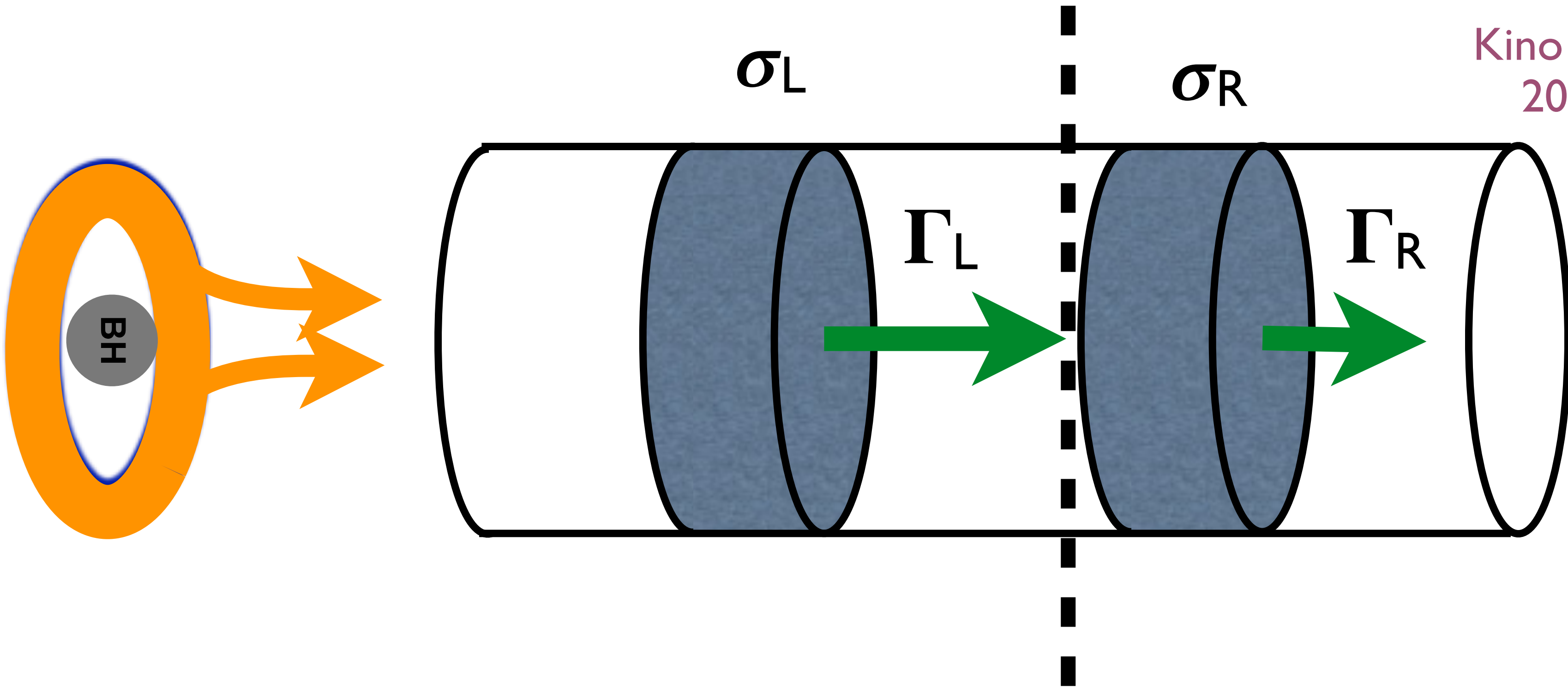
Outline

- Introduction
- Internal shocks model
  - Numerical calculations
- General parameter study
  - Spectral Energy Distribution
  - Photon spectral index
  - Compton dominance
- Conclusions

Internal shocks model

$$\sigma := \frac{B^2}{4\pi\rho\Gamma^2c^2} \qquad \Gamma_L := (1+\Delta g)\Gamma_R$$

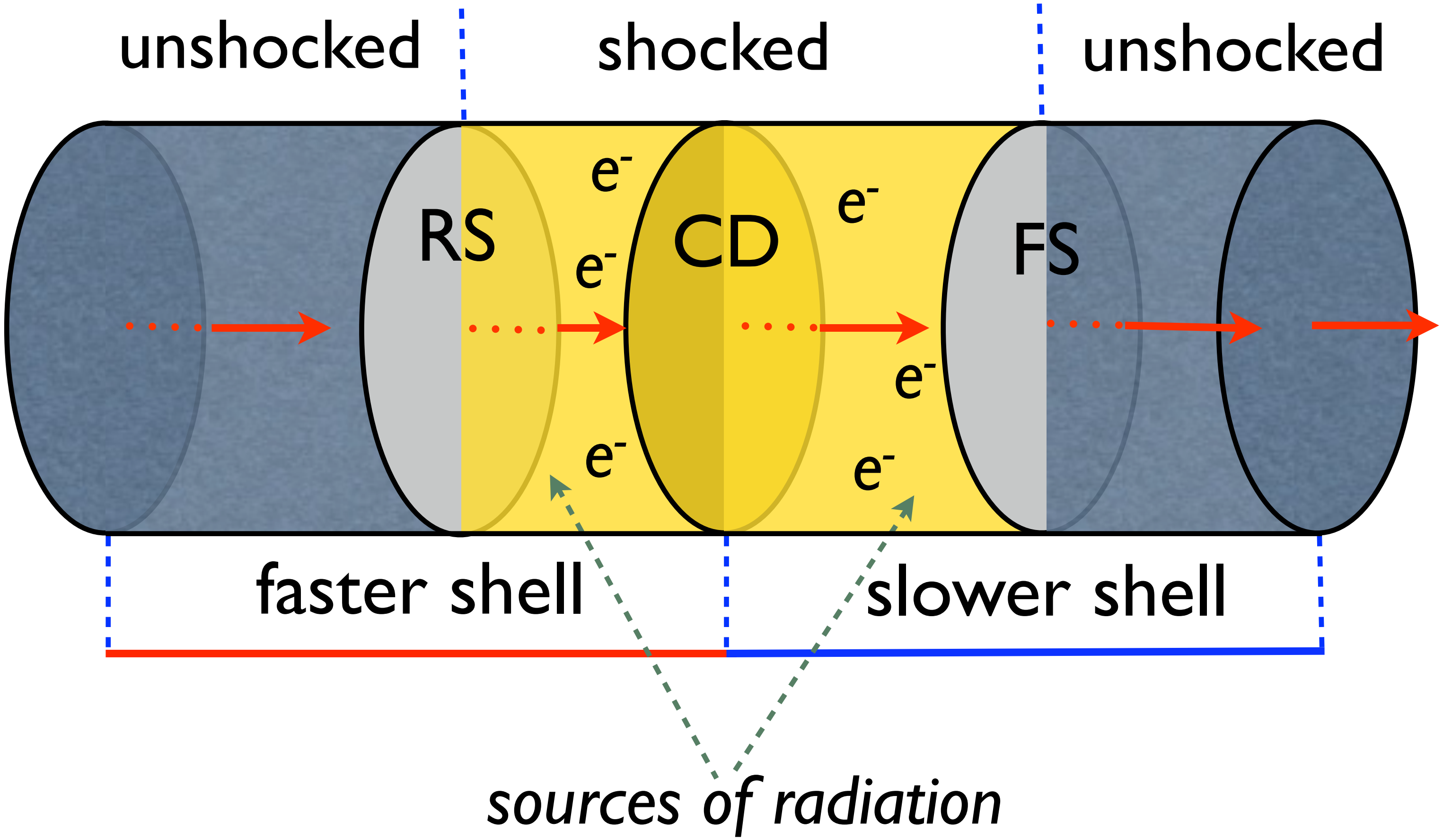


Kino et al. 2004

Mimica et al. 2004, 2005

Mimica & Aloy 2012

Internal Shocks model

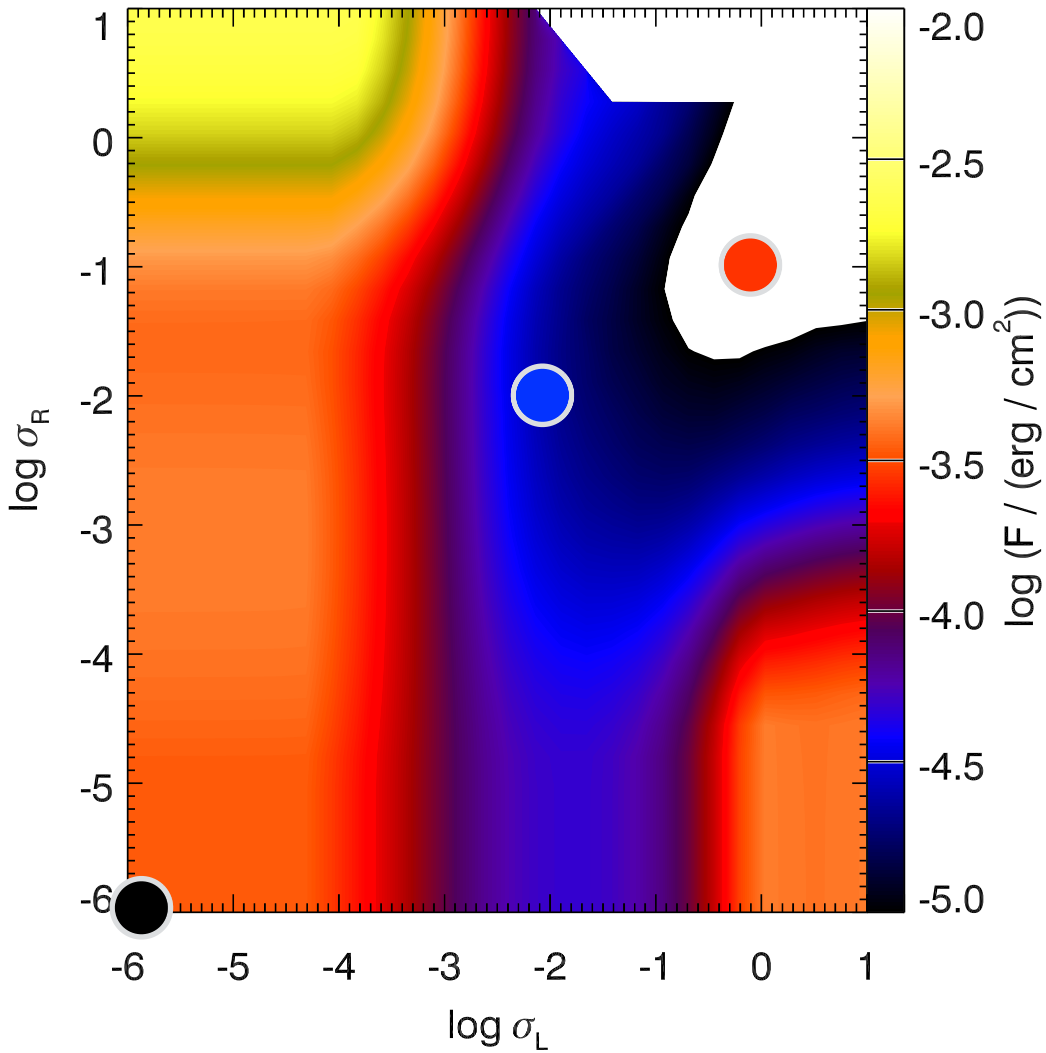


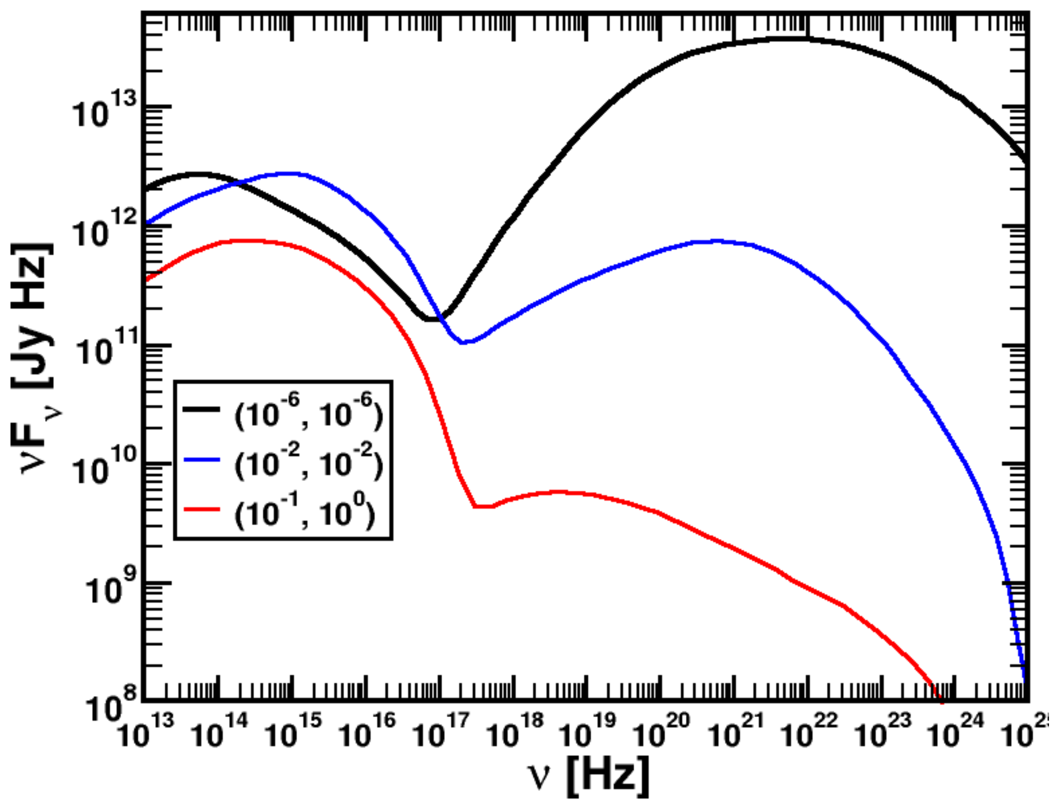
Böttcher & Dermer 2010

Joshi & Böttcher 2011

1. Solve a 1D Riemann problem (Romero et al. 2005)
2. Emission from non-thermal particles acceleration: synchrotron, Inverse Compton (Mimica 2004, Mimica et al. 2009)
3. Compute multi-wavelength light curves: radiative transfer equation (Mimica & Aloy 2012).

Global parameter study



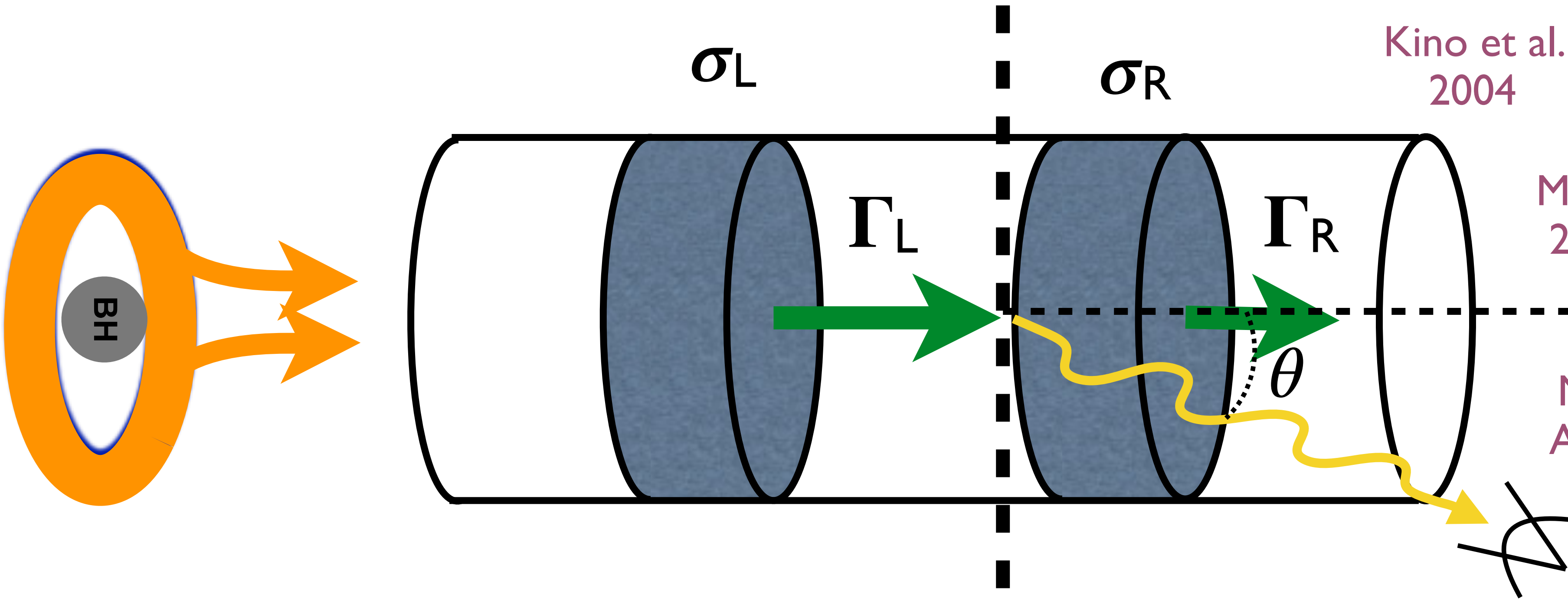


Mimica & Aloy 2012

Contours of the logarithm of the time-integrated (0–100 ks) and frequency-integrated (10^{12} – 10^{25} Hz) flux

Internal shocks model

$$\sigma := \frac{B^2}{4\pi\rho\Gamma^2 c^2} \qquad \Gamma_L := (1 + \Delta g)\Gamma_R$$



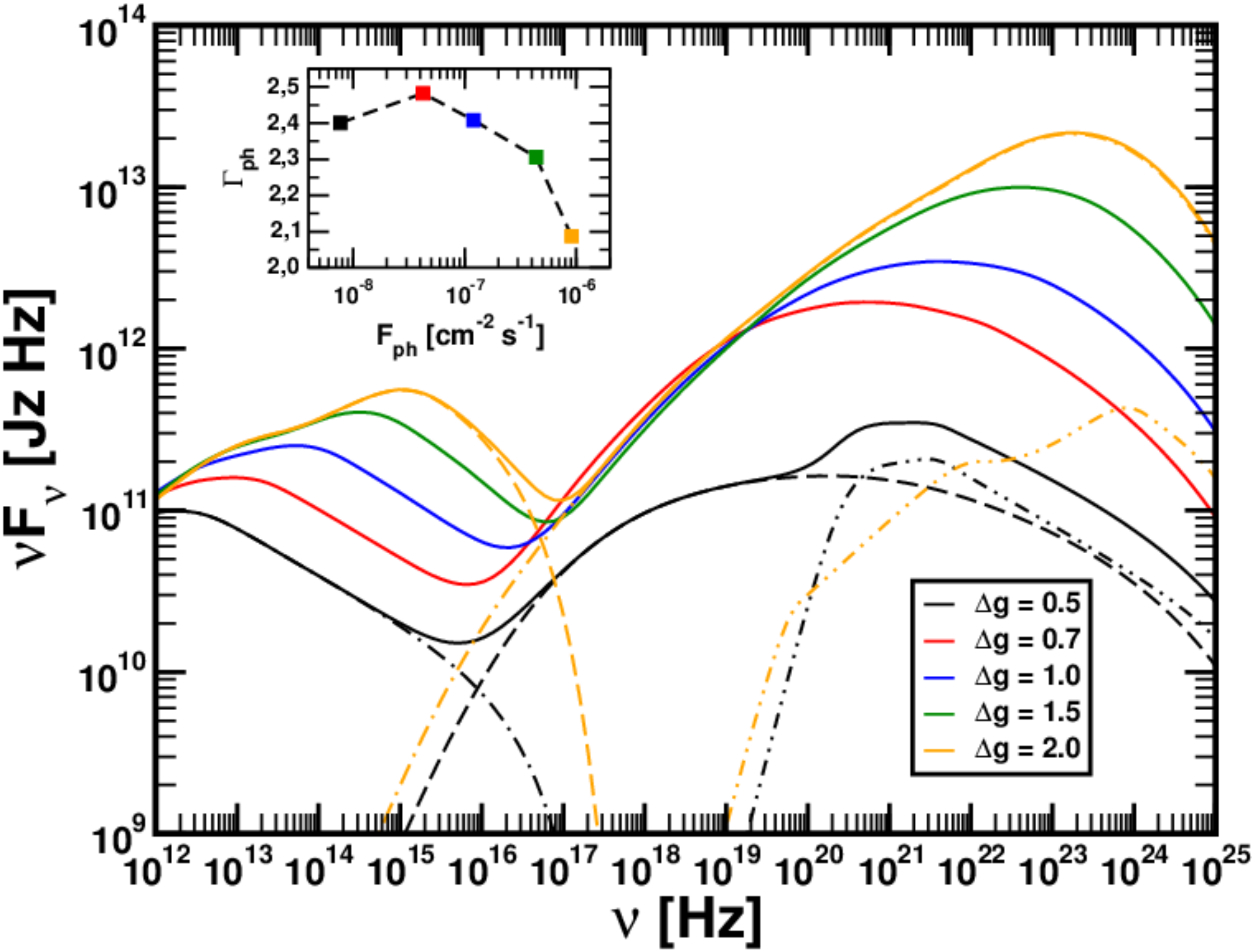
Kino et al. 2004

Mimica et al. 2004, 2005

Mimica & Aloy 2012

Spectral Energy Distribution

$$\sigma_L = \sigma_R = 10^{-6},\ \Gamma_R = 10,\ \theta = 5^o$$

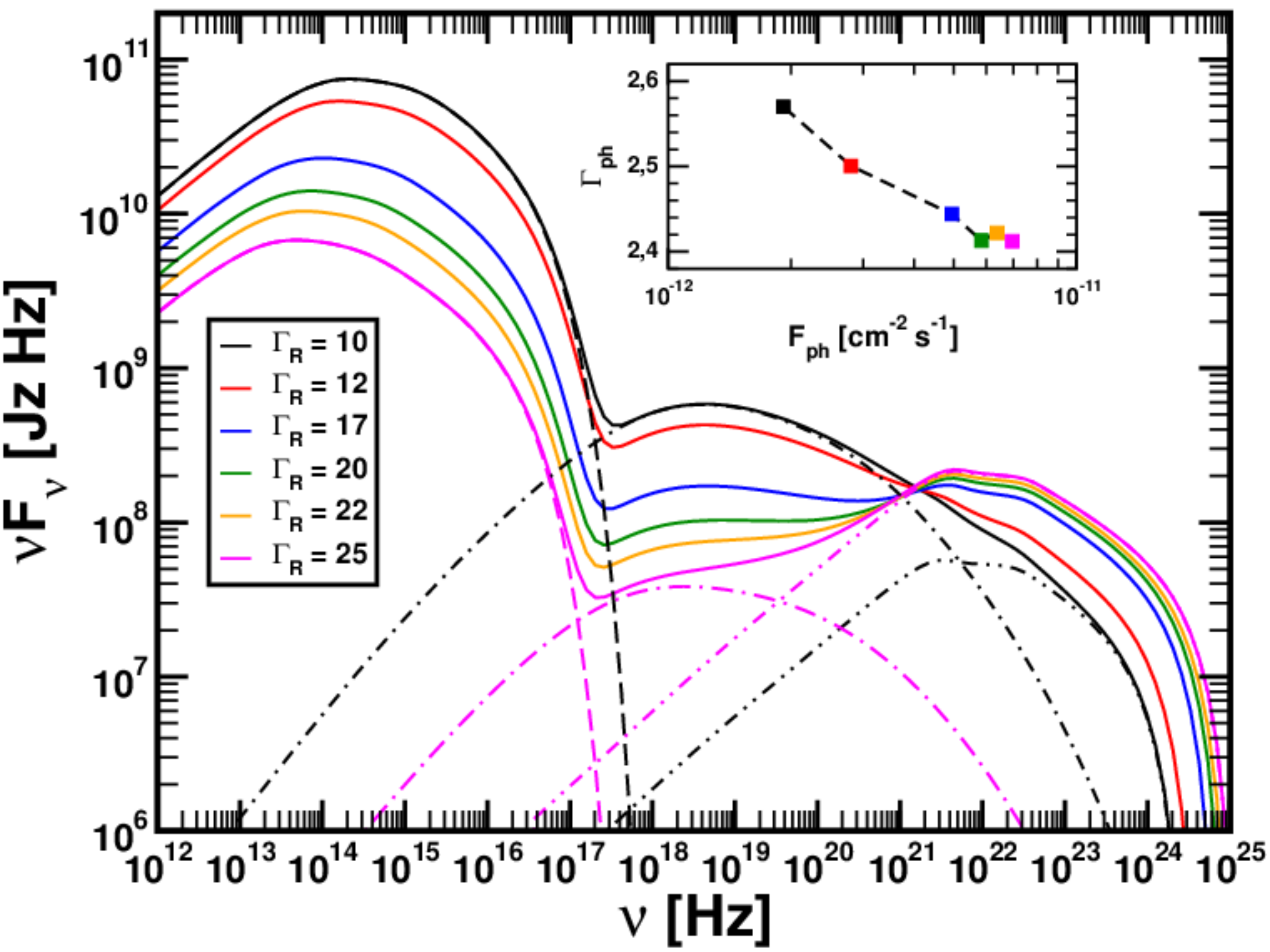


Averaged spectral energy distribution of weakly magnetized shells for different ***Δg***

RB, Mimica & Aloy 2014

Spectral Energy Distribution

$$\sigma_L = 1,\ \sigma_R = 0.1,\ \Delta g = 1.0,\ \theta = 5^o$$



Average spectral energy distribution of strongly magnetized shells for different Γ_R

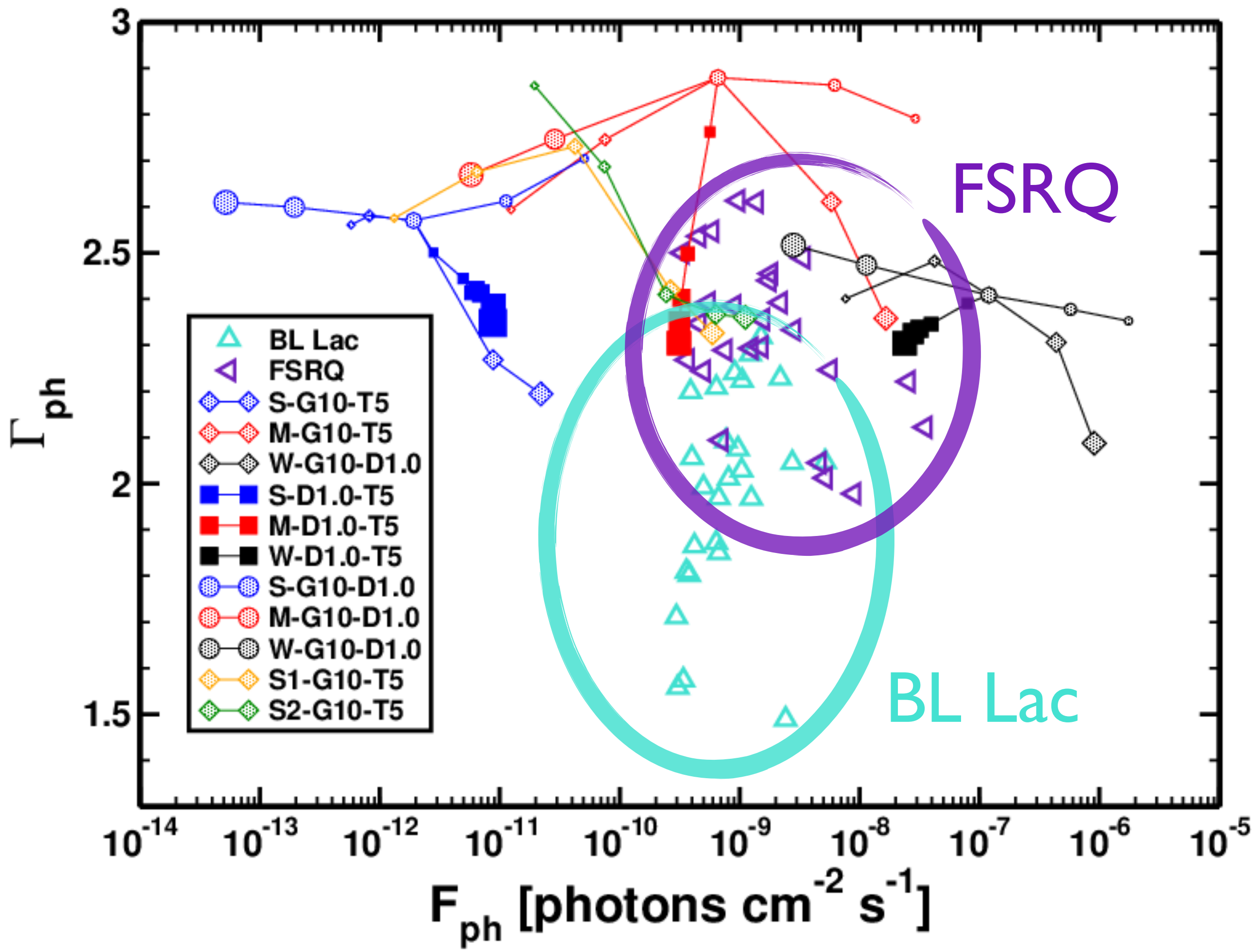
RB, Mimica & Aloy 2014

Photon spectral index

RB, Mimica & Aloy 2014

Photon spectral index vs. photon flux between 0.1 and 100 GeV

Comparison with 2nd LAT AGN catalog sources with 0.4 < z < 0.6 (Ackermann et al. 2011)

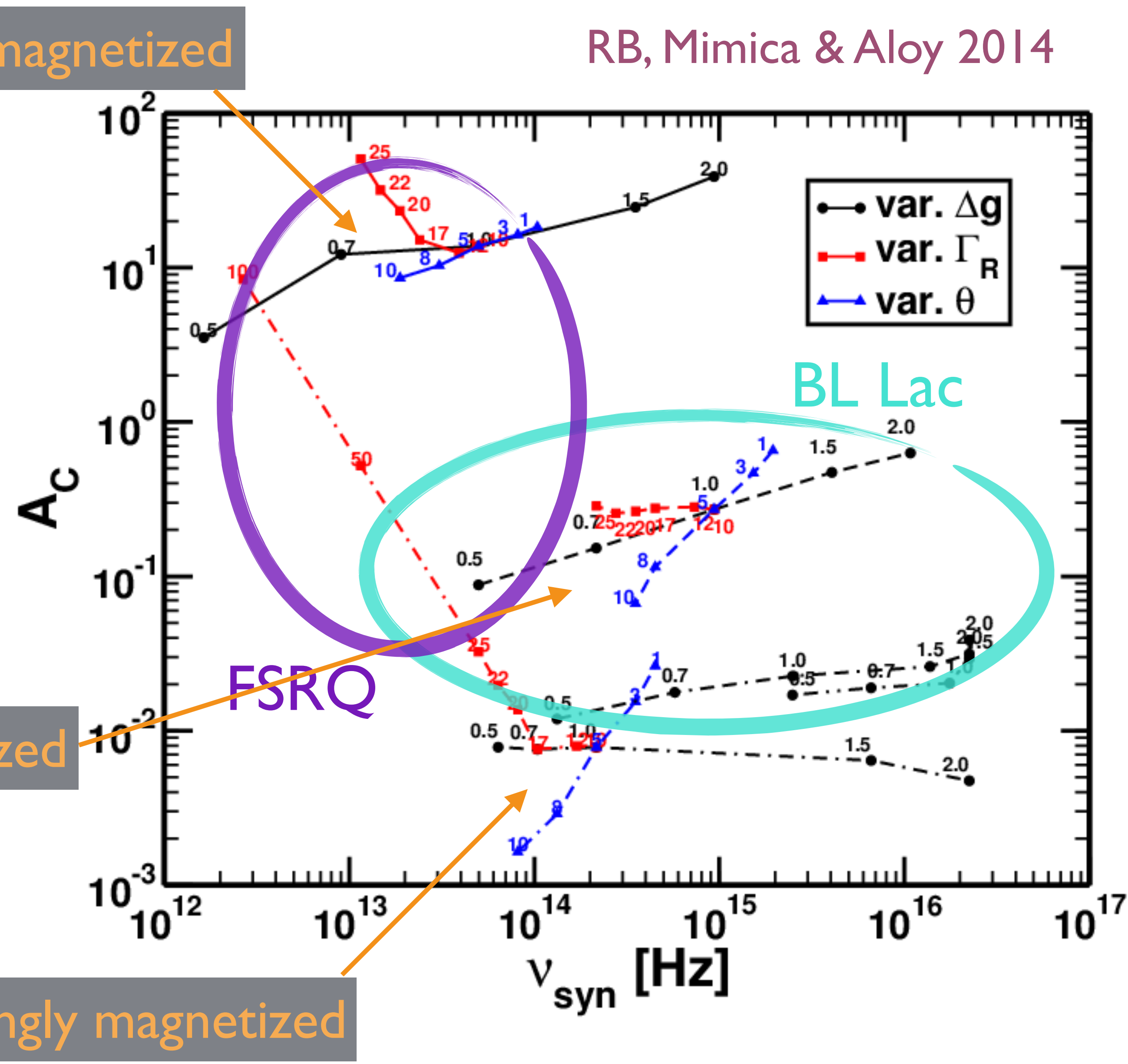


Compton dominance

$$A_C = L_{IC}/L_{syn}$$

Compton dominance vs. synchrotron peak (Finke 2013)

RB, Mimica & Aloy 2014



Conclusions

- Standard double-hump SED found in blazar observations can be reproduced not only for unmagnetized shells but also for ultrarelativistic ones, both kinematically and regarding its magnetization.
- When varying **Δg** we get a more energetic maximum in the IC component, dominated by SSC
- When varying **Γ_R** the EC begins to dominate over SSC, as well as being comparable to the synchrotron component.
- Simulations can help us to have a taste of the physics that may be happening within the jet.