Mirror Effects in Flat Spectrum Radio Quasars

Some remarkable events in: 3C 454.3, 3C 279, PKS 1830-211 and PKS 1510 show ratios between optical and γ-rays variation factors

$\rho = A_\gamma / A_{opt} > 2$ or more, that is, Compton dominance varies (Standard EC predicts $\rho = 1$).

Moreover, in these events the correlation between γ-ray and optical bands is often absent.

The Compton dominance attains values 100 or more

γ-flux shows doubling time of few minutes!

high energy spectrum can be unusually hard.

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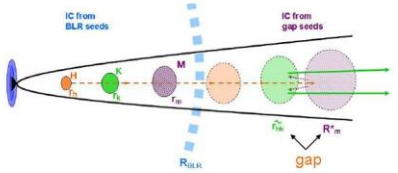
on behalf of the AGILE AGN WG

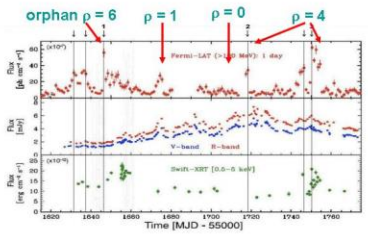


In the blob-frame the seed photon density due to the BLR is
$U'_{BLR} \sim 7\ 10^{-3}\ L_{D,46}\ \Gamma_k^2$ erg cm^{-3}
and the synchrotron energy density is
$U'_{syn} = B^2 / 8\pi \sim 4\ 10^{-2}$ erg cm^{-3}

In the gap the mirrored seed density attains
$U'_m \sim 2\ 10^{-1}\ f_{-1}\ L'_{syn,43}\ l_{m,16}^{-2}\ \Gamma_r^4$
and we can observe γ - flares rising to Compton dominance ~ 100 with rise-time $R_{BLR} / 8c\Gamma_k^2\Gamma_r^2$ of minutes

Here $\Gamma_r = 5$ is the relative boost-factor between blobs and mirror, and $f = 0.1$ the mirror reflectivity

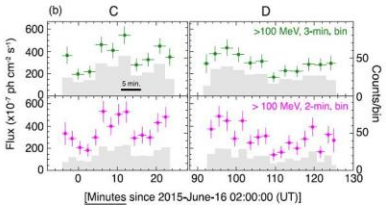
Photons emitted within the BLR are reflected far at
$R^*_m \sim 2 r_m \Gamma_m^2$
and re-enter when the incoming blob is close to the reflection point, in a "small gap"
$d_g \sim R_{BLR} / (2\Gamma_r)^2$
Here reconnection events are favoured.
($\Gamma_r \sim \Gamma_h / 2\Gamma_m$ is the relative boost beetwen blobs and mirror)



3C 279 shows in detail different kinds of correlation opt - γ.

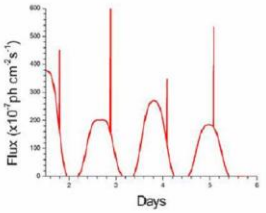
The correlation is often absent.

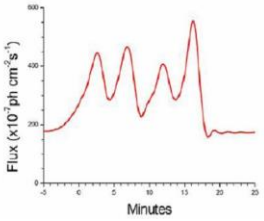
Compton dominance rises to values > 100 in few hours.
(Data: Hayashida et al. 2015)



Here the Compton dominance rises in few minutes!

To account for these behaviours, some variations are required in the external photon field seen by the moving blob.
(Data: Ackermann et al. 2016)





We observe strong mirror IC emission in γ rays up to 10^{49} erg / s and Compton dominance
$U'_m / U'_B \sim 10^2$

attained with rise time
$(1+z)\Gamma_m^2 R_{BLR} / (4c\Gamma^4)$ ~ minutes!
when $\Gamma \sim 20$ and $\Gamma_m \sim 2$ hold

These γ-spikes appear delayed by $R_m^* / 2c\Gamma^2 \sim$ half day
to respect the optical emitted within the BLR

Moreover, the absorption by pair production
$\sigma_T U_m d_g / 3\varepsilon \sim 0.3$
is low being the absorption path
$d_g \sim 3\ 10^{15}$ cm small.

(Vittorini, Tavani & Cavaliere 2017 ApJL 843, 23)