Millimeter monitoring,
or,
the trouble with AGN and gamma-rays

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Six times 3C 279, June 1991
- theoretical synchrotron spectra with little (no) connection to reality

- snapshots with no temporal framework or constraints

- (mainly) one-zone model spectra, in disagreement with the basic shocked jet framework
EGRET vs continuum sample: radio flare starts before gamma flare
[Valtaoja & Teräsranta 1995; Lähteenmäki & Valtaoja 2003]

P = 99.9%

3C 279: the more distant the shock, the weaker the gamma flare [Lindfors et al. 2006]

EGRET vs VLBI sample: new component emerges before gamma flare [Jorstad et al. 2001]

P = 99.98%

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All Continuum + VLBI data vs EGRET: strong gamma radiation comes from shocks on the average 2 months old (observer’s frame) = several parsecs down the jet [Jorstad et al. 2001; Lähteenmäki & Valtaoja 2003]

EC photons are here

Radio photons

Gamma photons

External Compton fails.
WHAT CAN mm-MONITORING DO? 2) Identify and separate the jet and the shock components in the sources at any given time [Lindfors et al., A&A 456, 895 (2006)]

19 frequencies
Michigan
Metsähovi
SEST
IRAM
JCMT
KVA
NOT
Perugia
Torino
+ literature data
3C 279 during the first 2 EGRET epochs: the true jet and shock synchrotron components revealed (Lindfors, Valtaoja & Türler, A&A 440, 845 (2005))

**Assumptions:** Marscher & Gear shocked jet model

**Numerical code:** Türler and Lindfors (3-D fit to all mf data)
SYNCHROTRON COMPONENTS + your favorite model → INVERSE COMPTON COMPONENT

![Graph showing the spectral energy distribution of 3C 279](image)
WHAT NEXT?

- SSC and EC both fail for 3C 279 at least
- improved SSC calculations ?
- mirror Compton from dust etc.?  
- internal shocks?

something crucial is missing...

GLAST + multifrequency/VLBI monitoring
MULTIFREQUENCY VLBI (up to 3 mm)

MULTIFREQUENCY MONITORING (up to optical)

GLAST + AGILE + TeV + X-RAYS

Identify the shock and the jet components in the synchrotron SED, get their spectra, size, $B$, $n_e$, $\Gamma$, $\theta$, ...

(insert a theoretician here)

Get the inverse Compton SED