Taking a view at Blazars from another angle

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ENIGMA set out to study AGN through variability.

Being humans, this implied that we worry about small-scale emission regions (t ~ 30 yrs ~ 10 pc)

How relevant are these scales?
Where is(are) the emitting region(s)?
Cross-identifications and decomposition

Taking a view at Blazars from another angle

We said *AGN, but mostly discussed Blazars.*
Their variability is most spectacular (relativistic aberation).
For addressing the questions ...

How relevant are these scales?
Where is(are) the emitting region(s)?
Can we cross-identify and decompose?

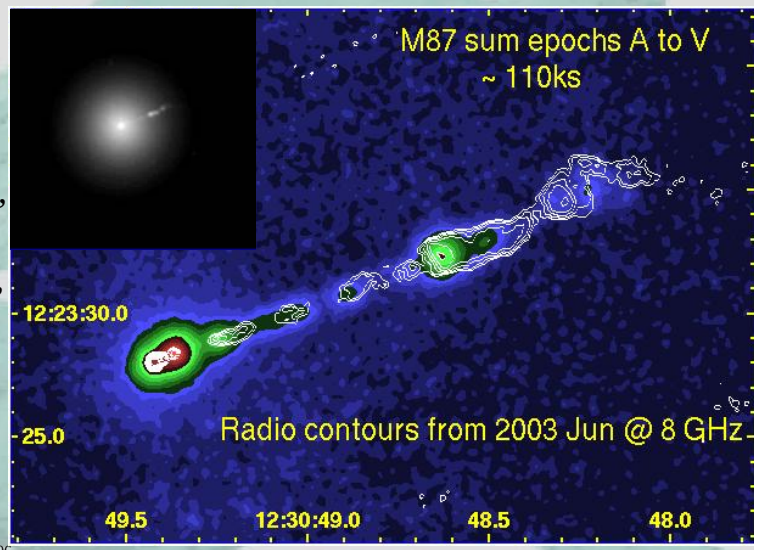
... Blazars (believed to be seen jet-on) are not ideal.
According to unification, FRI sources are off-axis Blazars

8th ENIGMA meeting Otaniemi September 8, 2006

M 87

The first (1918), the closest (in the north), brightest (most bands), and best studied jet

Off-axis (7-30 deg) Blazar



D.Harris, 2006

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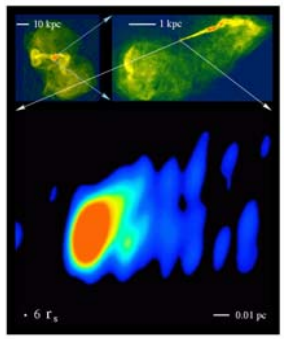
Sizes and IDV

In IDV discussions it is often argued that radio-sources are synchrotron self-absorbed at radio frequencies on the linear scales that are inferred from radio-IDV.

This has never been proven.

In M87 it was shown to be incorrect:
1 light-day corresponds to ~3 10^15cm, taking different angles between M87 and IDV sources into account, this corresponds to ~10^17cm, approaching resolved scales in highest resolution VLBI studies of M87



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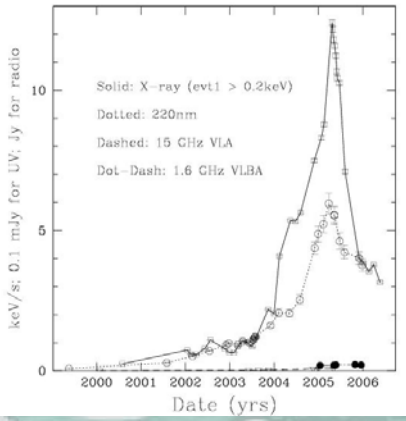
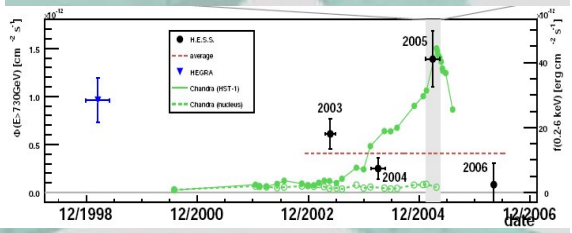
... Monitoring II: Fluxes

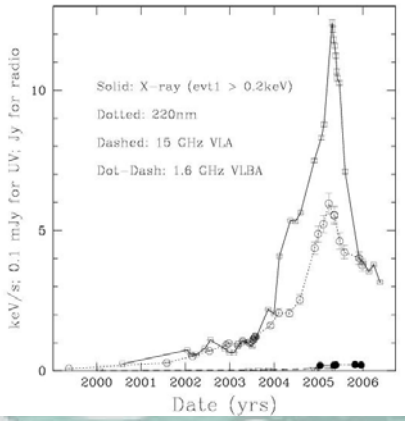


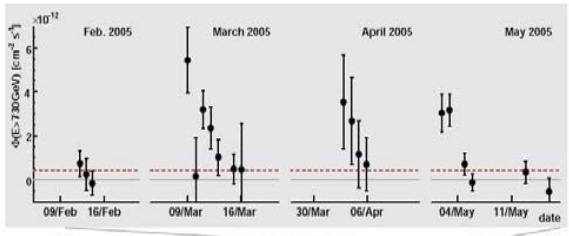
Radio, optical, xrays, gamma-rays

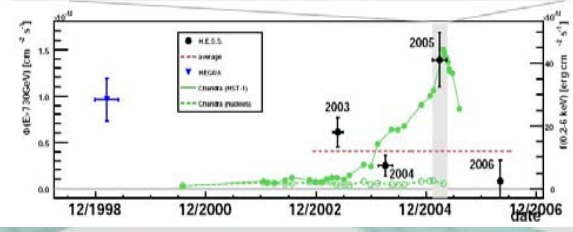
show variations on scales of months



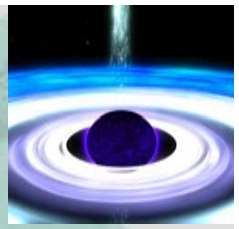
... Monitoring III: Flares







The Black Hole



Short time scales <=> Small distances?

10^16cm ~ few R_g

Kerr Black Hole in magnetic field will develop large electric potential and huge EM force, accelerating charged particles to very high energies (Slane et al., 1980)

Problem: B ~ 10000 G required for $1M_9$

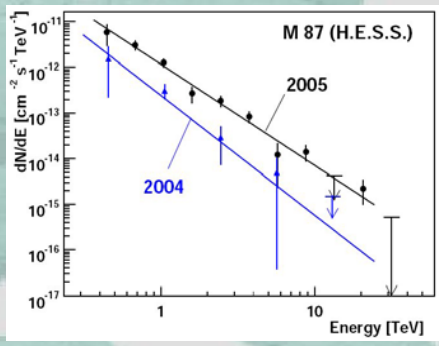
Do we know magnetic fields?

The jet

M 87 is an off-axis Blazar

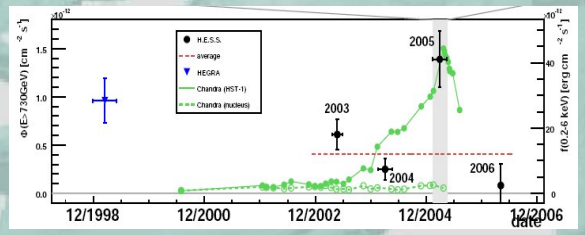
Central parsec-scale jet base would be similar to on-axis Blazars (D is reduced by an order of magnitude)

VHE gamma-rays will be produced in a similar way, the time-scales are reduced by an order of magnitude. The spectra and SED would be similar.



The knot HST-1

Similar long-term light-curves suggest
gamma-ray emission from HST-1.
Some sub-volume has to be even
more compact than morphological limit.



Also the site of rapidly variable component?

Fast variations

Fast variations in VHE gamma-rays were detected
in 2005 (high level) only (up to now)

Possibly a selection effect
(would have been hard to detect at lower level)

No variations on similar timescales have been seen
at X-ray/optical/IR/radio wavebands
(few simultaneous observations, though)

Not many reported searches on these time-scales.

But they are expected in IC models!

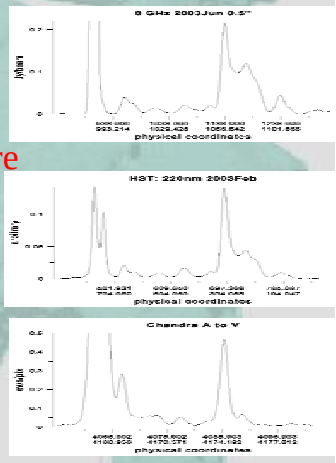
Musings

How relevant are these scales?
Very (50% amplitudes)
Note these are volume filling factors of 10^-20
enormous dynamic ranges in emissivity

Where is(are) the emitting region(s)?
Anywhere
One-two-many (HST-1, knot A, base of jet)?
When seen end-on, superpositions of many
One source of VHE emission?
All sites emit X-ray, optical, and radio emission

Musings

Where is(are) the emitting region(s)?
All of them may have compact substructure
Superposition of many
components along the los
timing-noise
SED superposition



Cross-identifications and decomposition
What is quiescent emission?
Jet-emission between knots (dynamic range problem)
timing noise, isolated flares, => lots to be done

Ever more riddles