SIMULTANEOUS MULTIWAVELENGTH OBSERVATIONS OF THE BLAZAR 1ES 1959+650 AT A LOW TEV FLUX

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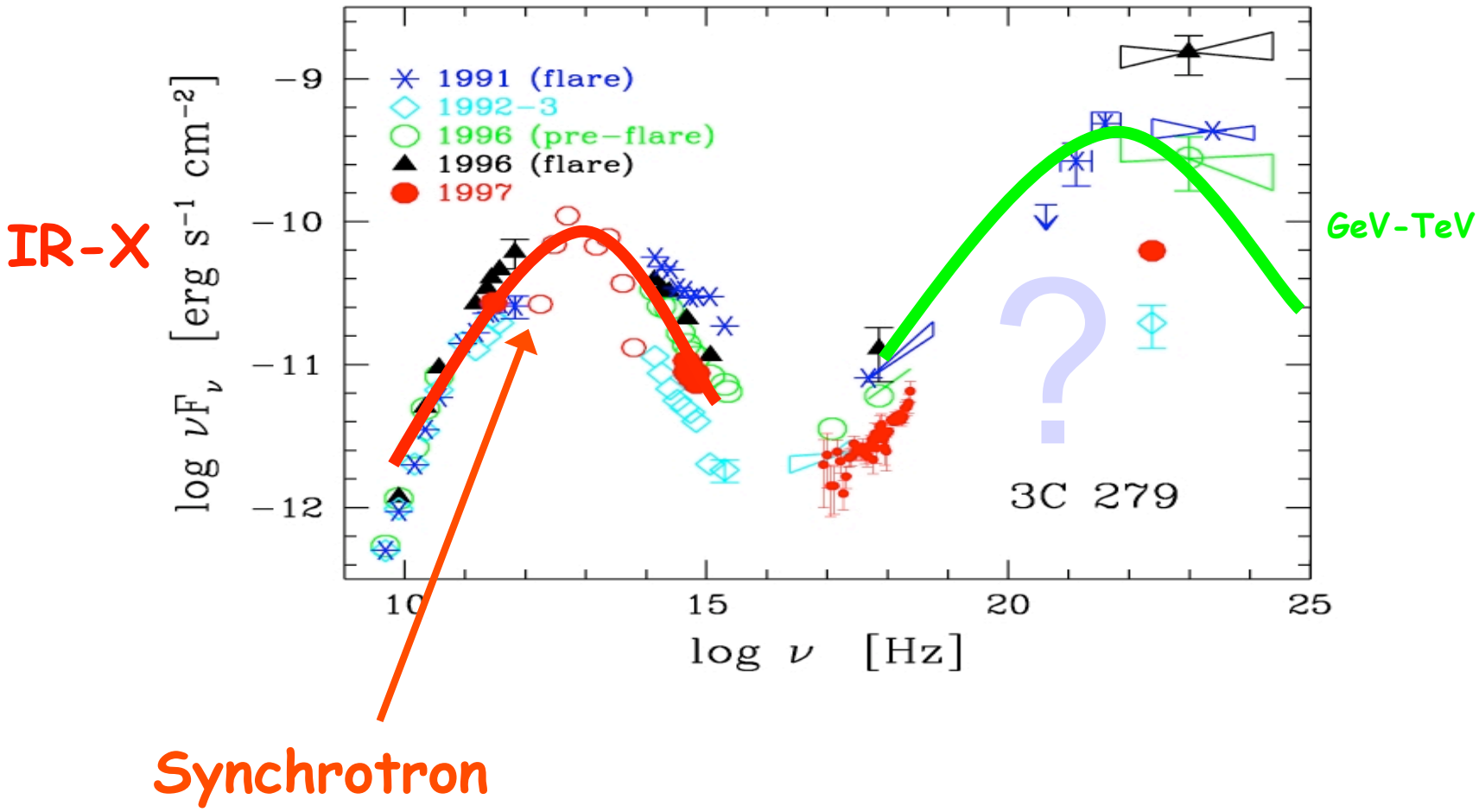
The blazar jets

- Non-thermal emission over a large energy band
- Highly variable, with different properties at the various wavelengths
- SED characterised by two broad components

Therefore, simultaneous MW observation are very important to understand their properties

The double bump

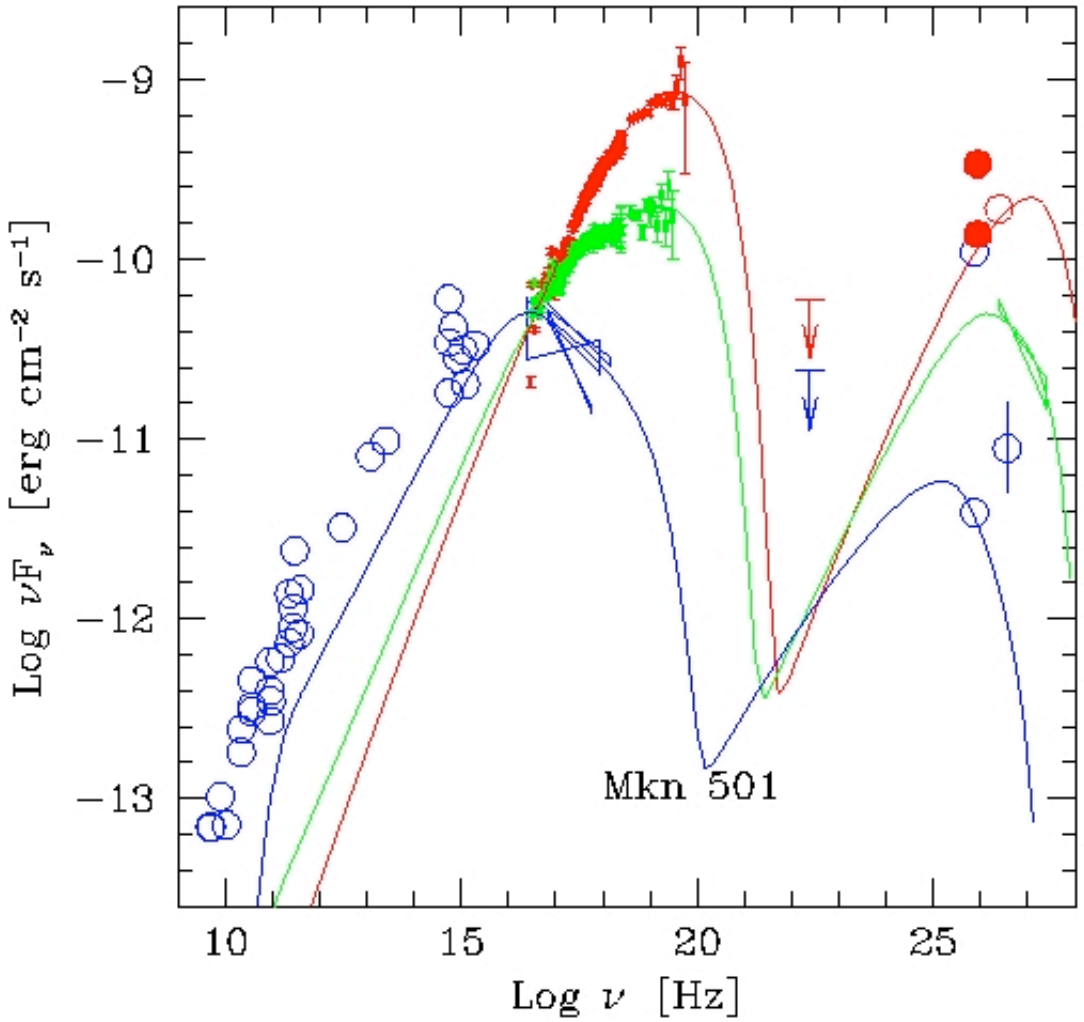


Wehrle et al. 1998

The MW observations

- There have been various MW campaign organised by different groups
- Observations from the radio to the TeV band using on ground facilities and satellites
- We organised a number of campaign, concentrating in particular on the X-ray (BeppoSAX and XMM-Newton) and optical bands and on sources that were in an active state

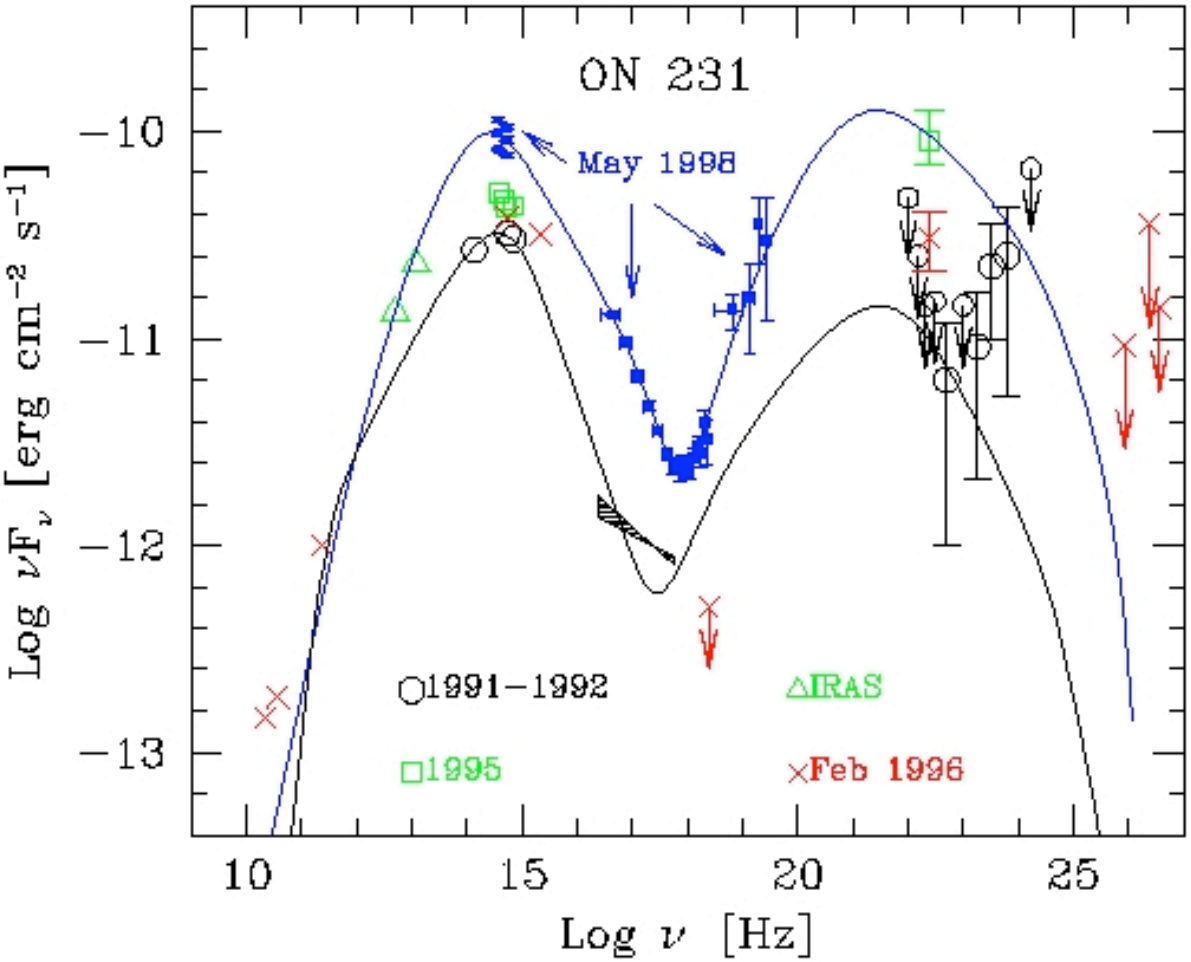
The BeppoSAX Observation of MKN 501 in an active state



Pian et al. 1998, ApJ 492, L17

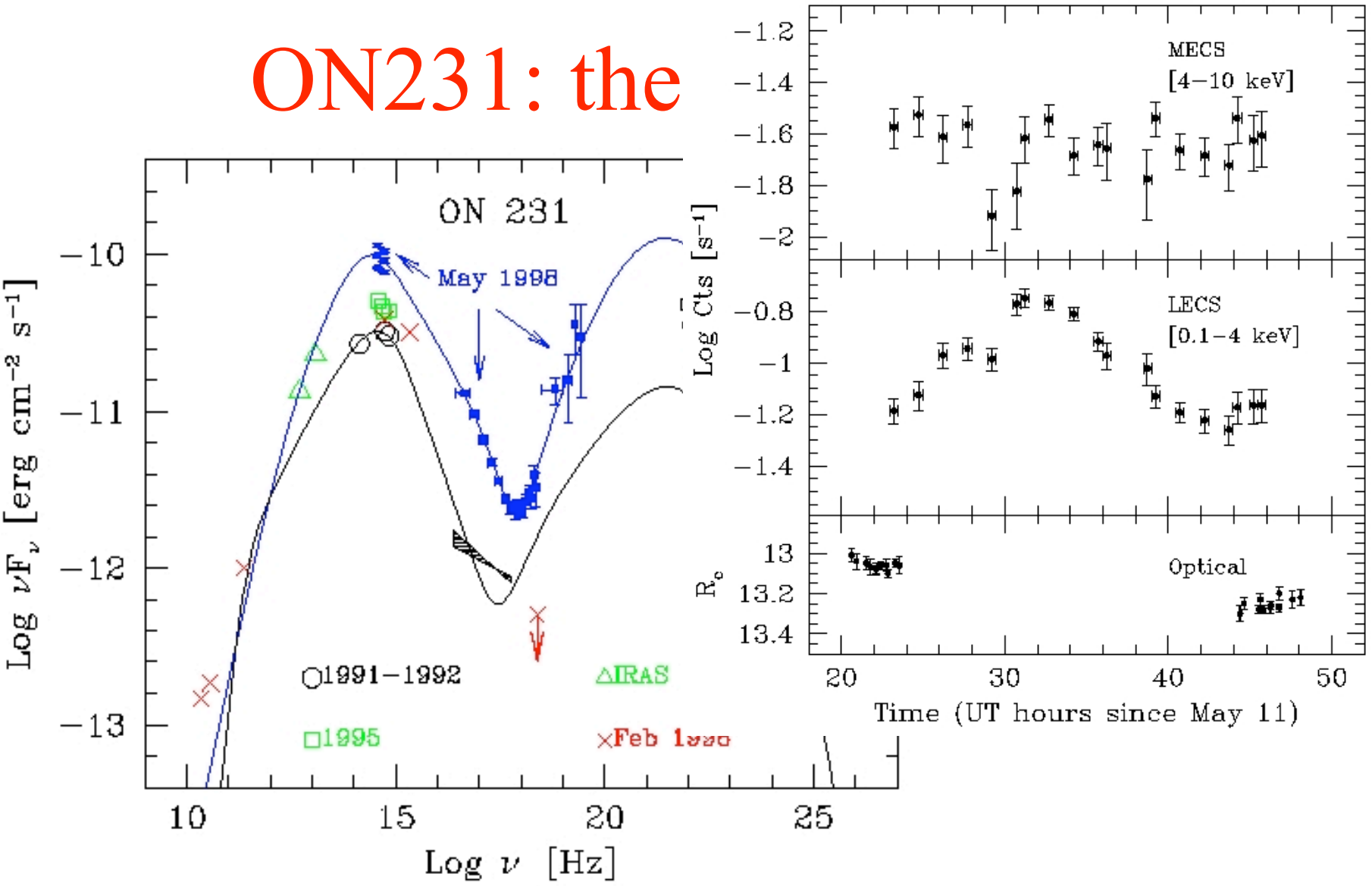
Source	Obs. Date	Exp.	Trigger
ON 231	11 May 1998	25ks	Optical
	11 Jun 1998	32ks	
PKS 2005-489	01 Nov 1998	52ks	X-ray
BL Lac	05 Jun 1999	54ks	Optical + X-ray
	05 Dec 1999	54ks	
OQ 530	03 Mar 2000	26ks	Optical
	26 Mar 2000	23ks	
S5 0716+714	30 Oct 2000	43ks	Optical
MS 14588+2249	19 Feb 2001	48ks	Optical
1ES 1959+650	23 Sep 2001	7ks	Optical
	28 Sep 2001	48ks	
S5 0716+714	04 Apr 2004	50ks	Optical
S5 0716+714	24 Sep 2007	50ks	GeV

ON231: the SED



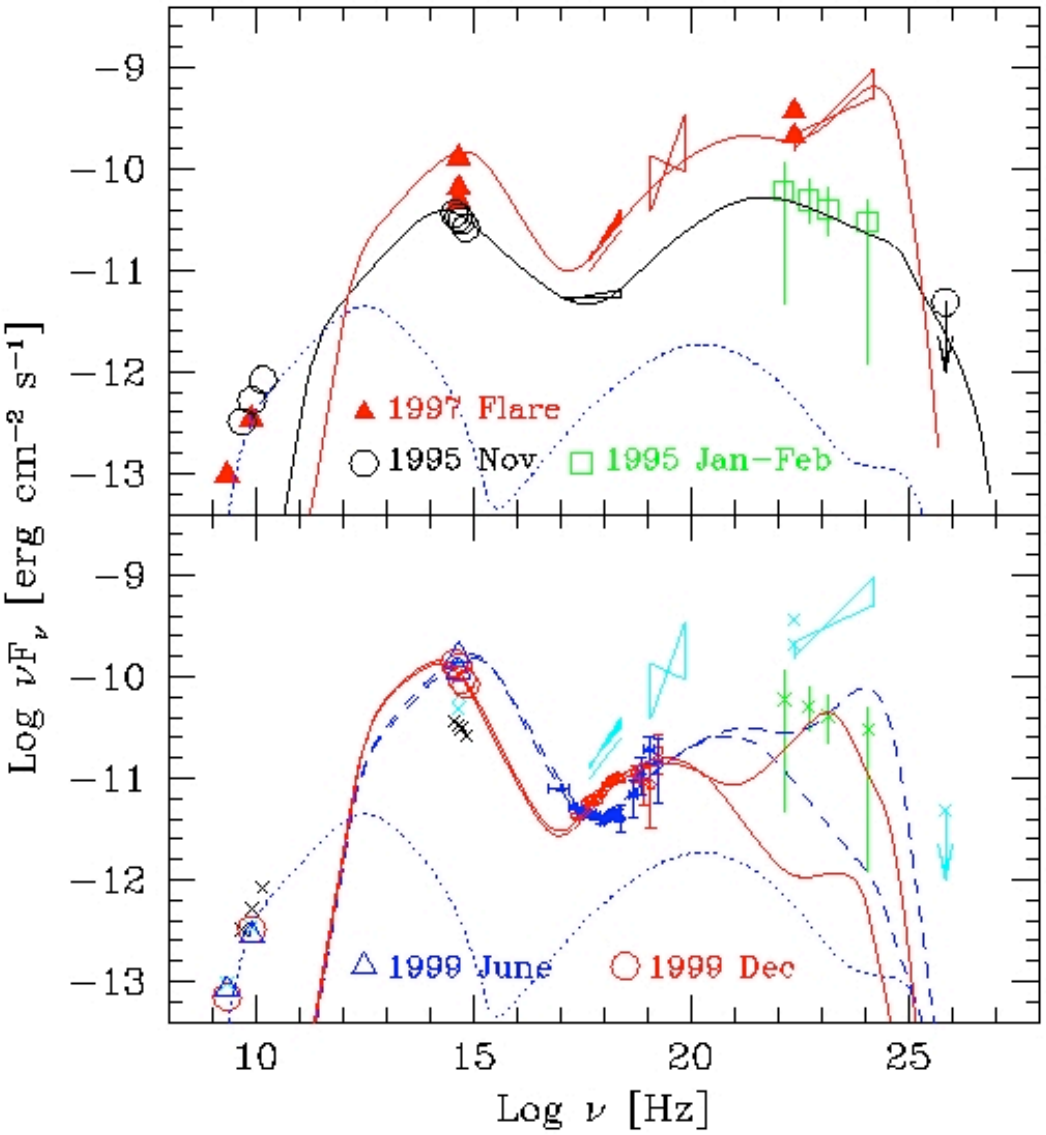
Tagliaferri et al. 2000, A&A 354, 431

ON231: the



Tagliaferri et al. 2000, A&A 354, 431

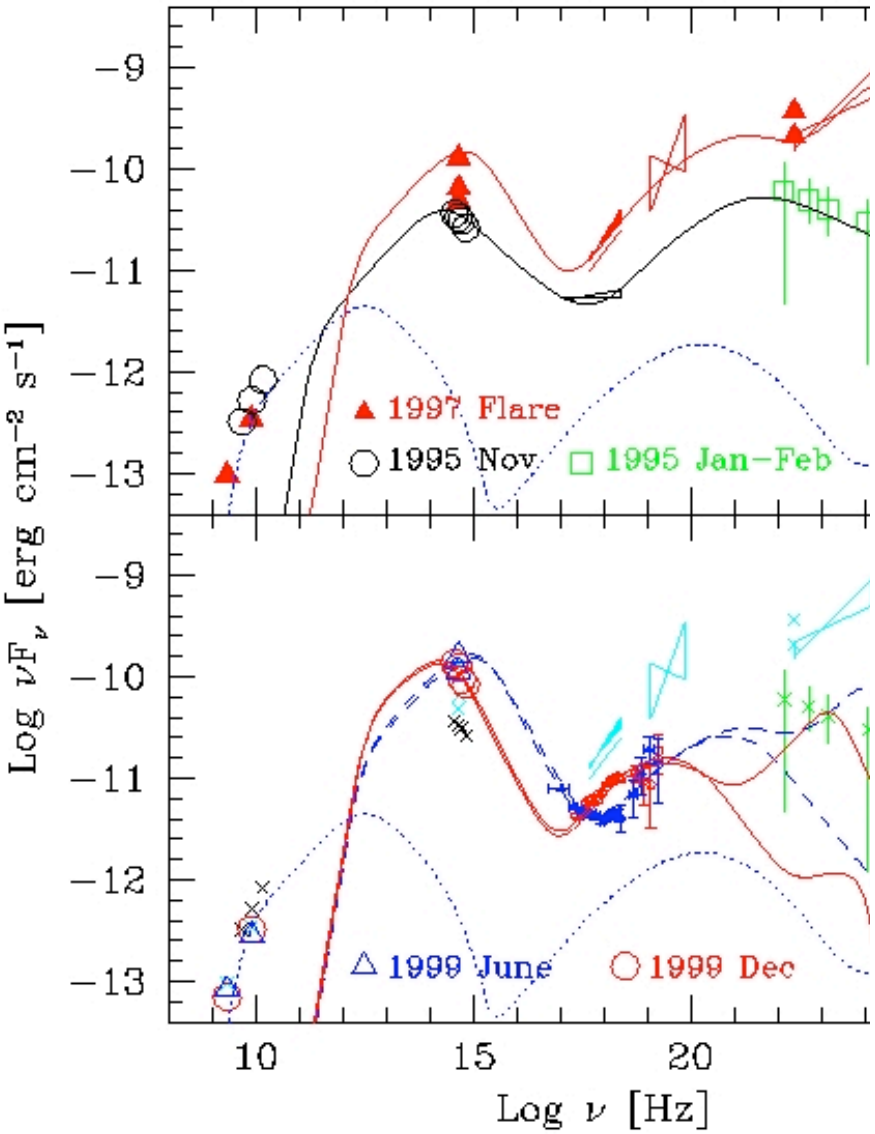
BL Lac: complex spectrum

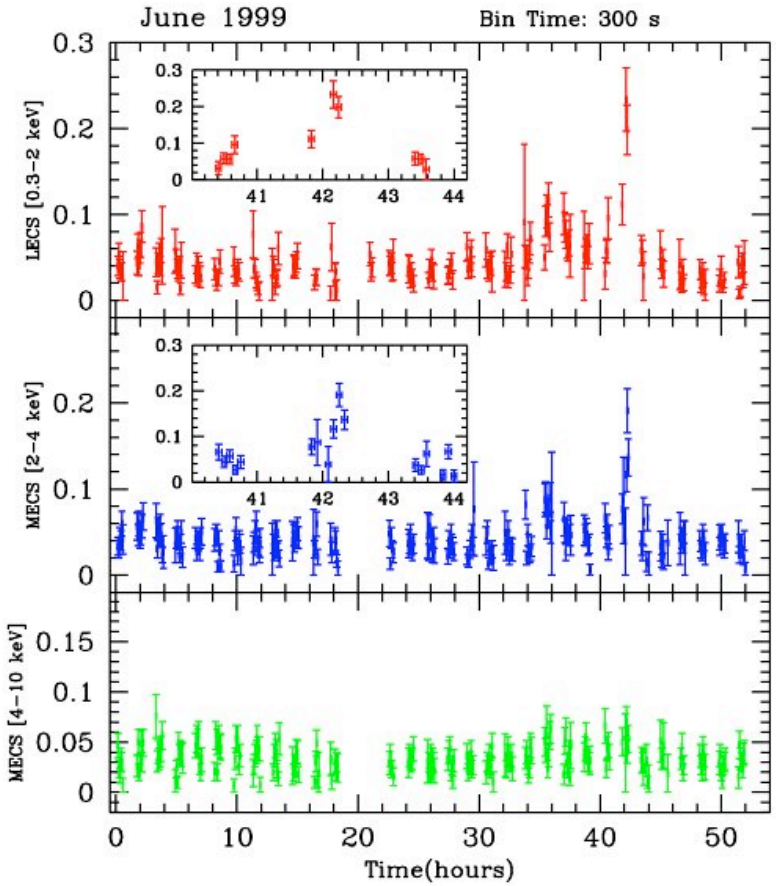


Simple but effective SSC + external Compton scenario. Importance of the location of the emitting region with respect to the BLR

Ravasio et al., 2002, A&A

BL Lac: complex spectrum





The problem of getting a MW too

- the observation of a blazar in an active state allow to test the models in extreme condition stretching the parameter space, but it is very difficult (often impossible) to get many observatories to repoint a target on a very short notice
- however, a very large band coverage (in particular the simultaneous coverage of both SED peaks) is also very important in order to discriminate between the various models (e.g. the observation of BL Lac)
- therefore we are also trying to get simultaneous optical-UV-X-ray and TeV observations of selected blazar, even if they are not in an active state

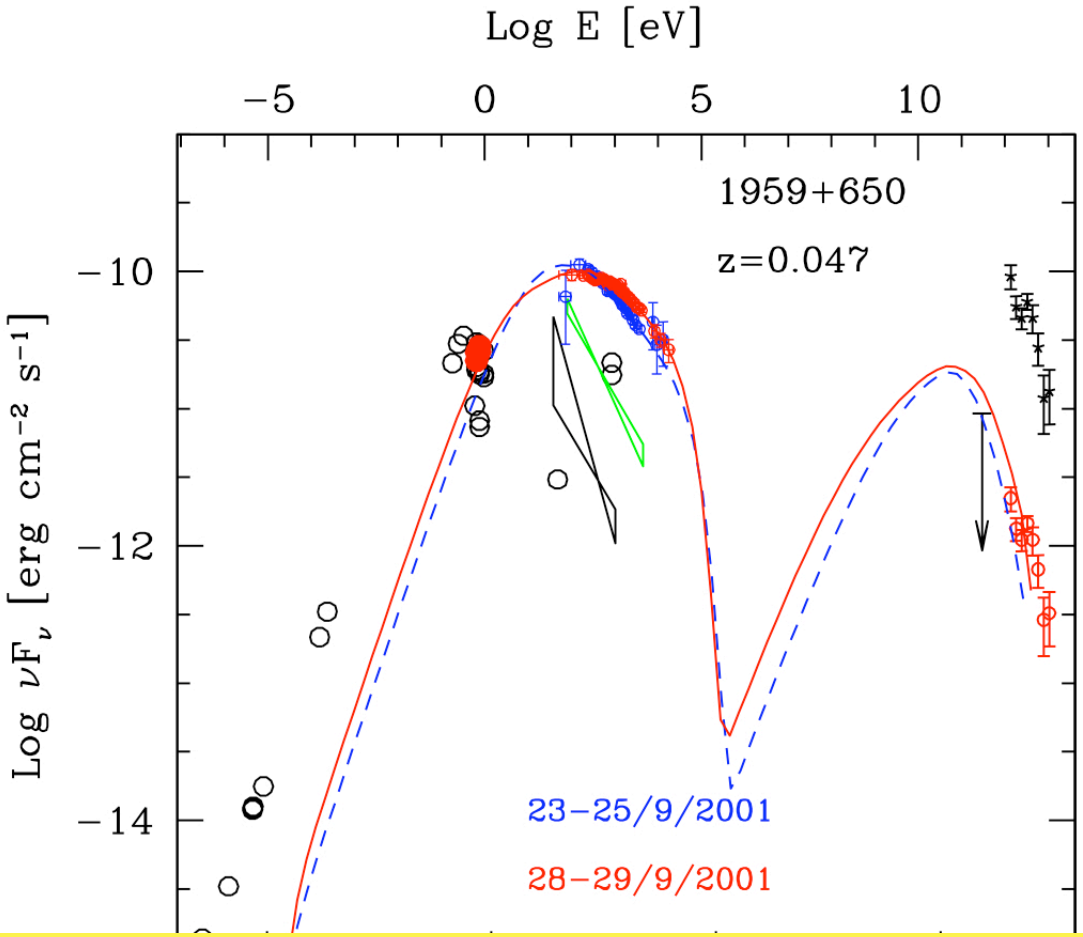
1ES1959+650

- This source is an HBL very bright in both X-ray and bands

- An "orphan" TeV flare, without an X-ray counterpart been detected on May 2002 (Krawczynski et al. 2004)

- We already observe this source while it was in a high state with BeppoSAX (Tagliaferri et al. 2003)

1ES1959+650

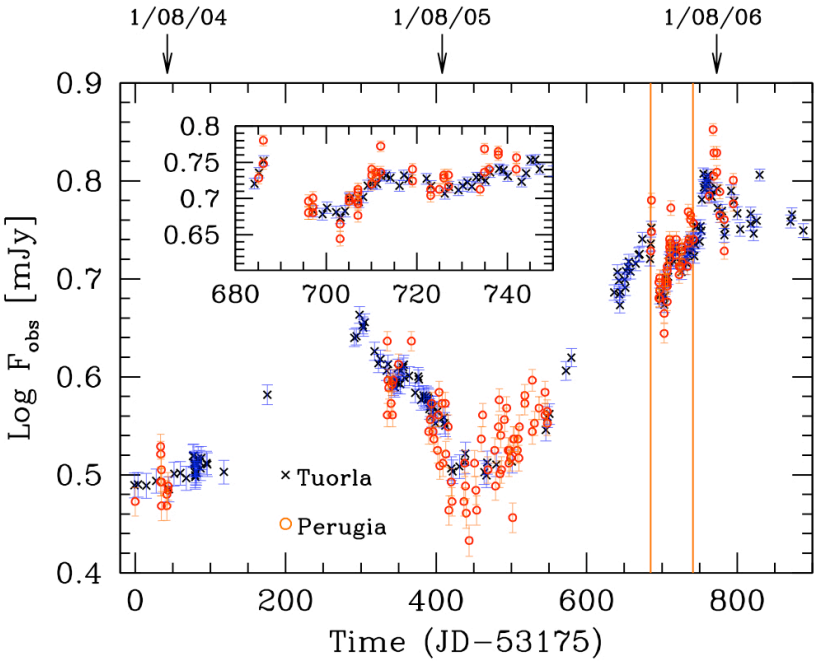


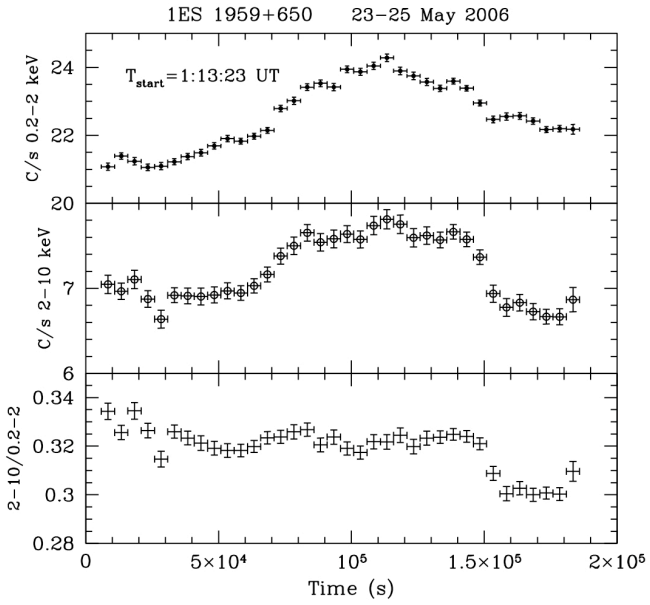
On May 2006 we performed a MW campaign with the Suzaku and Swift satellites, the MAGIC TeV telescope and on ground optical telescopes

The May 2006 MW campaign on 1ES1959+650

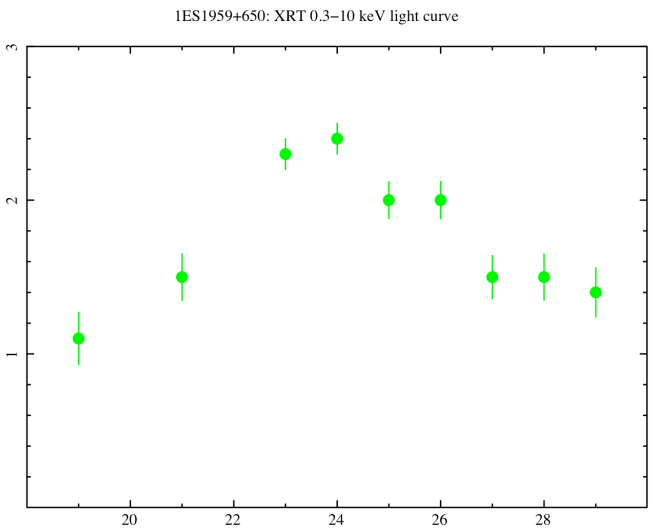
- The campaign was organised around the Suzaku and Magic observations.
- We were monitoring the source also in the optical and succeed in getting these observations while the source was quite bright in the optical

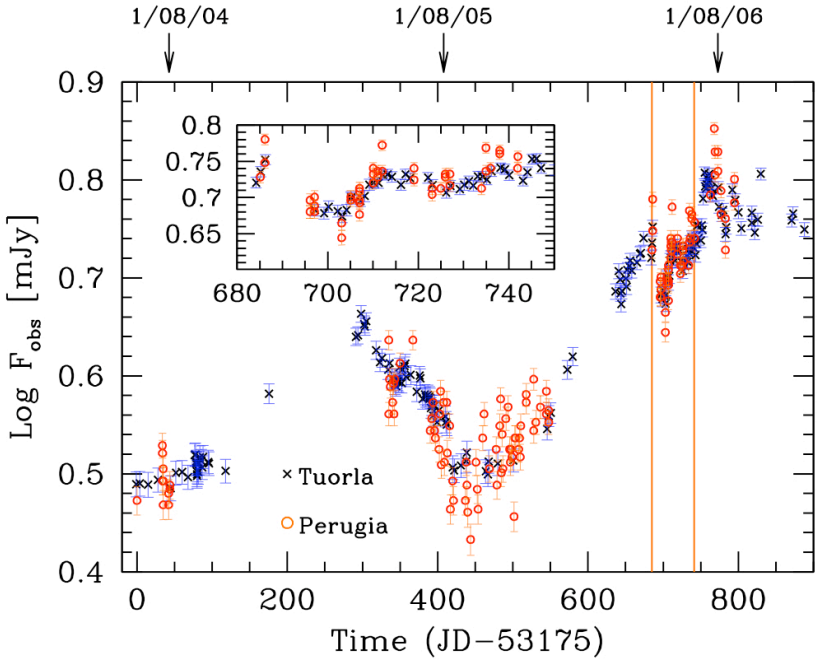
Tagliaferri et al. 2008, ApJ 679, 1039

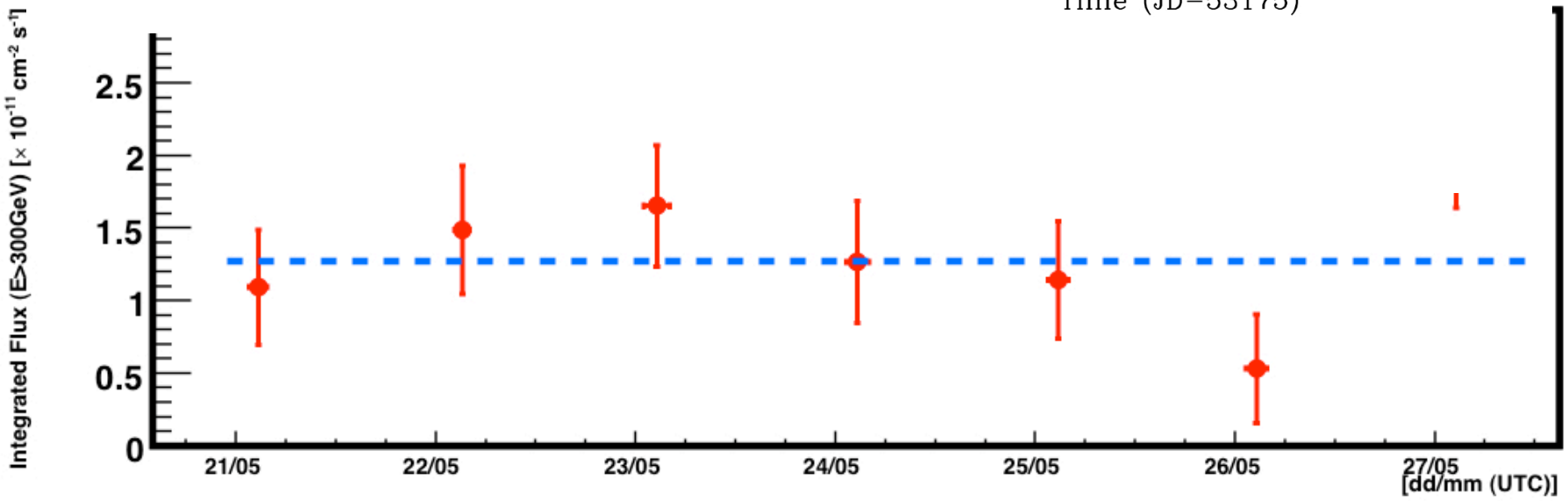




The May 2006 MW campaign on 1ES1959+650

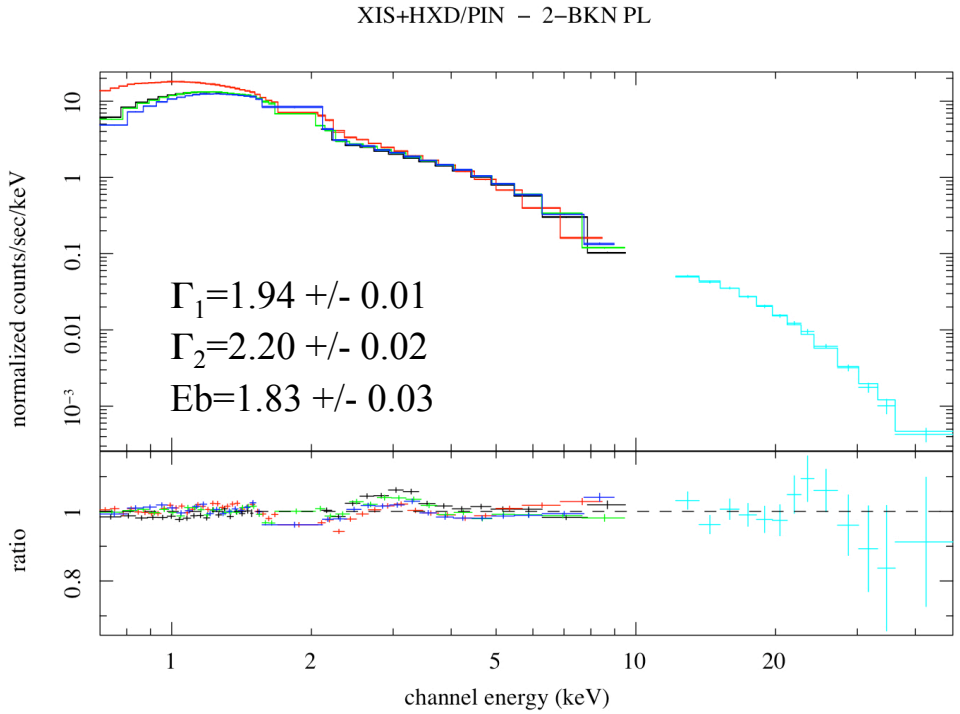


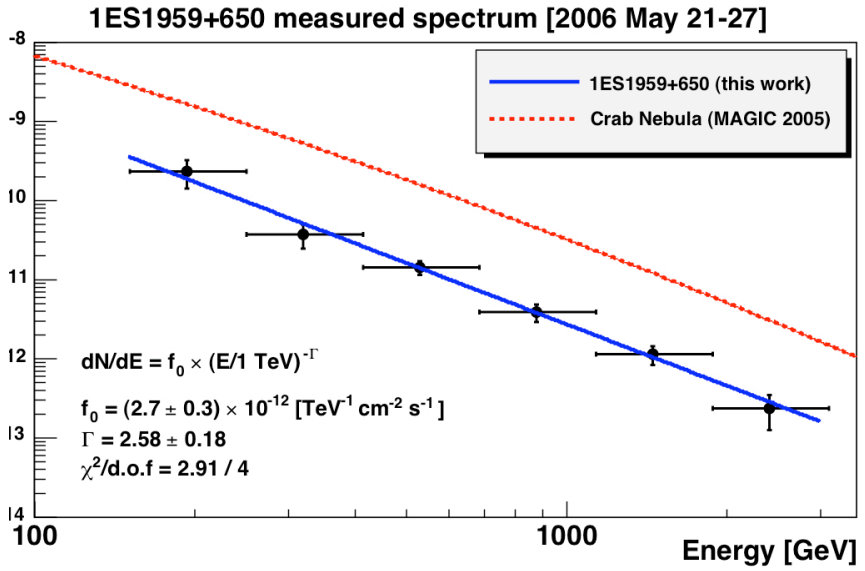




The May 2006 MW campaign on 1ES1959+650

The spectrum





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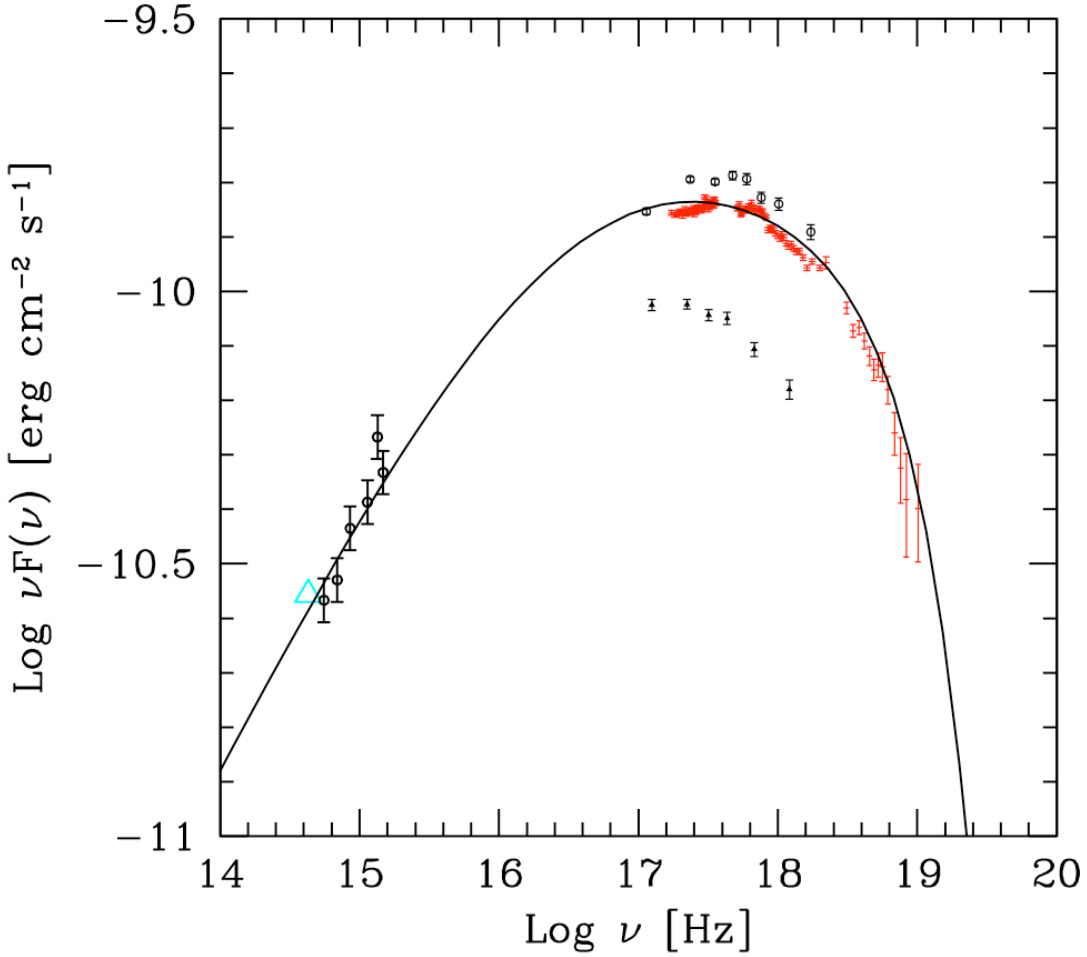


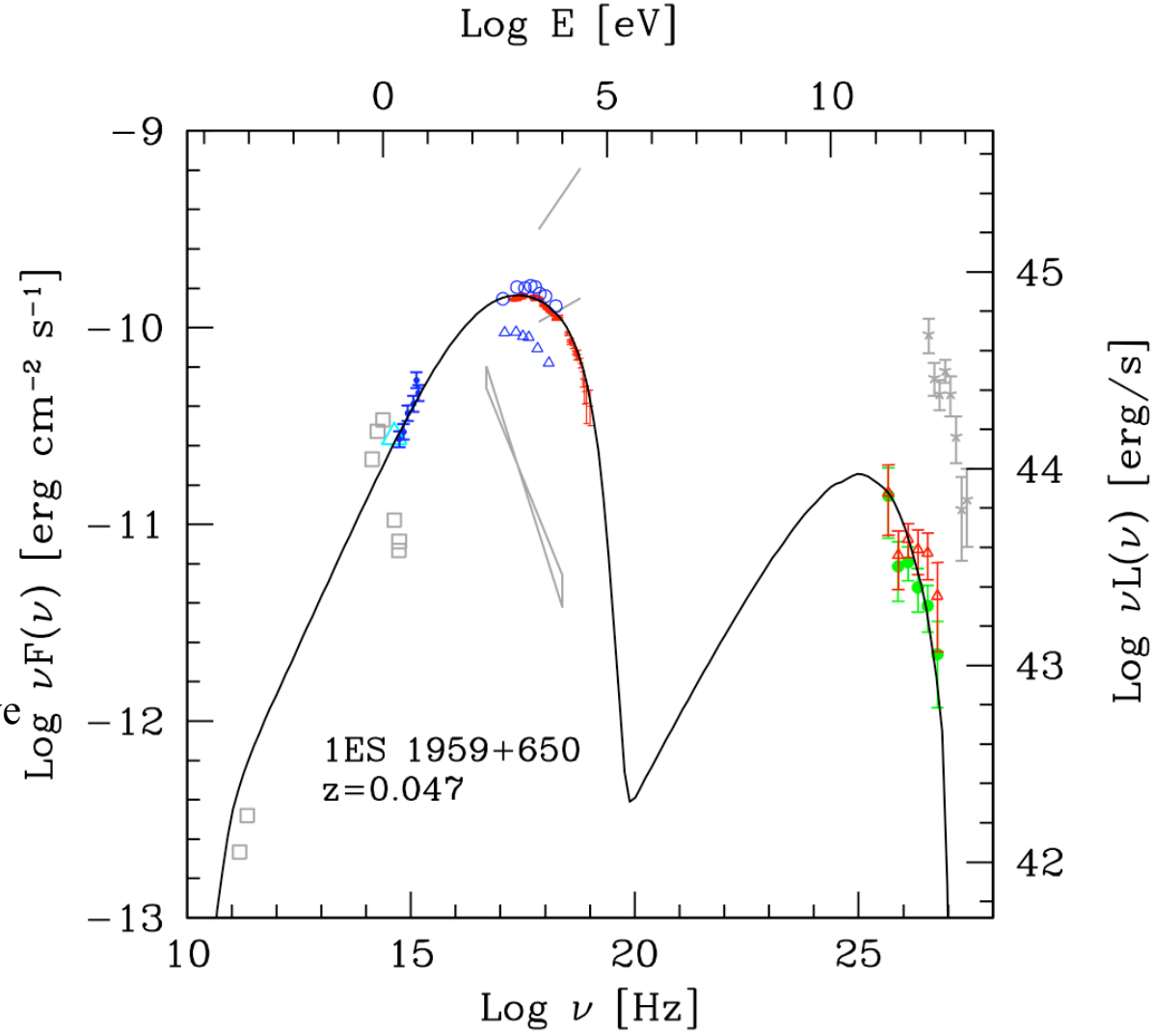
The May 2006 MW campaign on 1ES1959+650

The SED

- X-ray flux ~2 higher, optical similar, TeV ~2 lower
- Synchrotron peak moves to higher energies
- overall variability < ~2

- Synchrotron peak higher than Compton peak

Assuming a one-zone SSC model we derive parameters typical of HBL objects (δ=18, R=7.3x10^{15} cm, B=0.25 G, L'=5.5x10^{40} erg s^{-1})



The May 2006 MW campaign on 1ES1959+650

The X-ray variability

Higher variability above synchrotron peak

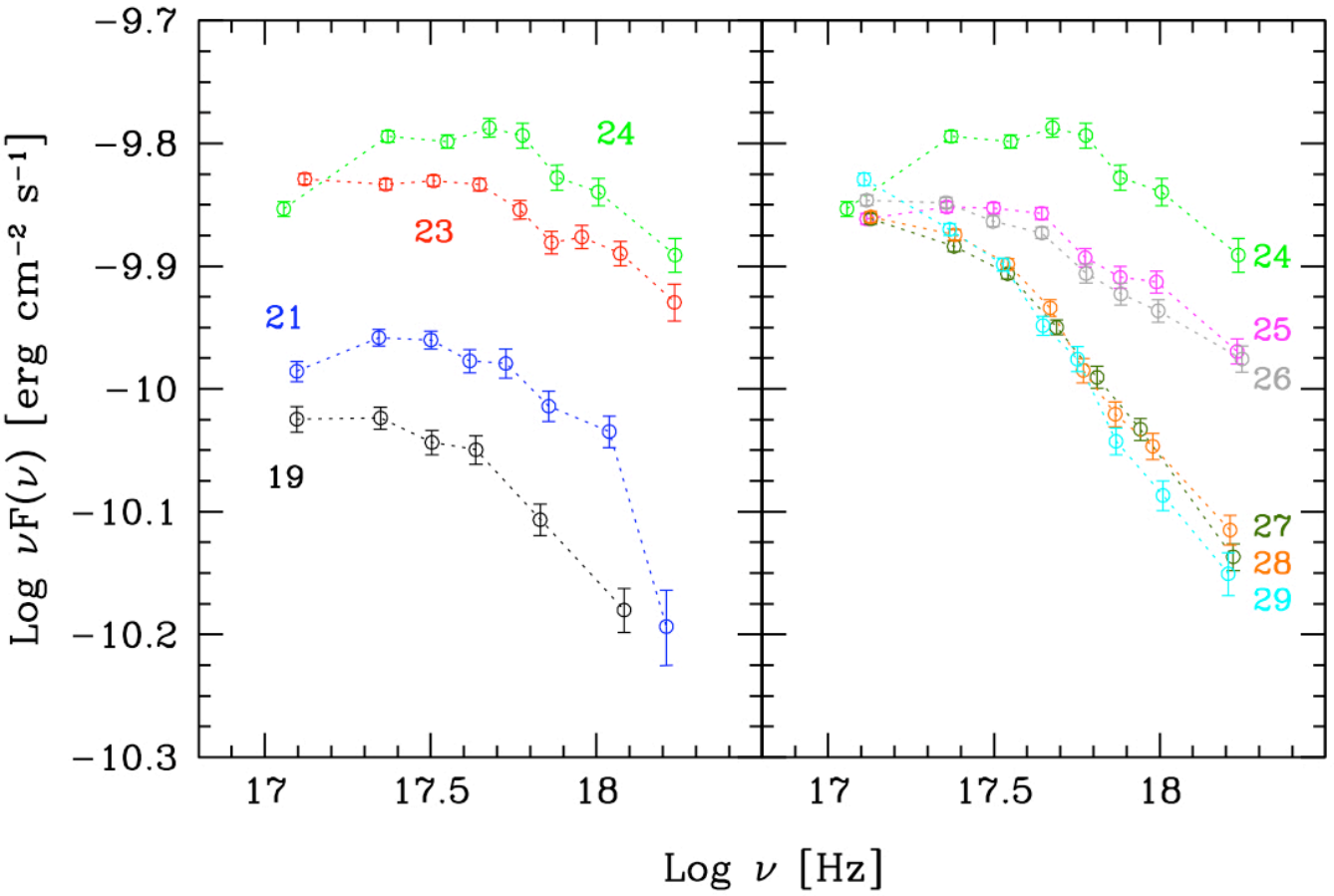
Not random, but follow a raising/decaying trend of ~10 days

A single blob would have move by ~2.7 pc

=> difficult to be explained by the internal shock model

⇒"Standing shock" (e.g. Krawczynski et al. 2002, Sokolov et al. 2004)

The XRT spectrum



Conclusions

1ES1959 MW campaign of May 2006

1. Source was bright in the X-ray and optical bands, weak in the TeV band
2. Synchrotron peak much higher than Compton peak, SED can be fitted by a one-zone SSC model
3. Overall variability ≤ 2
4. X-ray variability follow a trend over at least 10 days and can be explained by a "standing shock scenario"