The light curve of 1WGA J0447.9-0322 from the Asiago plate archive

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Who is WGA 0447.9-0322

A Flat Spectrum Radio Quasar detected in the ROSAT All Sky Survey:

First appears in the literature in the WGA and PMN catalogues (1995)

It is present in the REX and DXRBS samples of Blazars.

z=0.774 from emission line MgII 2900 A, E.W. 200 A

$F_{(5GHz)}$= 56 mJy (PMN survey) log(P) = 26.4

B =16.03 (GSC2, 1983) M_B = -28.0

$F_{(1keV)}$= 2.0E-13 erg/cm2/s (WGA catalogue)

From the F(radio)/F(opt) ratio it is a mild Radio Loud source (R=23)

The radio power is border-line for a FR II source, but it is unresolved with the VLA (Landt et al. 2005).

It is one of the "X-ray strong" FSRQ discovered by Padovani et al. (2003), falling in the HBL region of the (α_{ro} - α_{ox}) plane.

Despite its relative brightness, it was never studied for optical variability

How much is WGA 0447-032 variable?

- HBL are not strongly variable in the optical
- QSO (both radio loud and radio faint) are slowly variable
- What are the variability characteristics of our source ?

- We looked for an answer in the historic images of the Asiago plate archive

The Asiago plates

In the Asiago plate archive we found:

61 plates from the 67/90 cm Schmidt

205 plates from the 40/50 cm Schmidt

Most of the plates are 103aO (with or without GG13 filter) covering a band similar to the B filter, but there are also Panchromatic plates.

The plates were taken as part of the Asiago Supernova sky patrol (Mu Eridani field) and never used for AGN searches.

The time span is September 1962 to January 1991.

The plates were scanned with an EPSON 1680 Plus at 1600 dpi in transparency mode, in the framework of the national project of digitization of the plate archives of the Italian Astronomical Observatories (Barbieri et al. 2003).

Photometric calibration

The transparency Data Number were transformed into Intensity using the relation I=(V-N)/(T-N),

Where V is the value of the unexposed plate

N is the value of dark areas (overexposed stars)

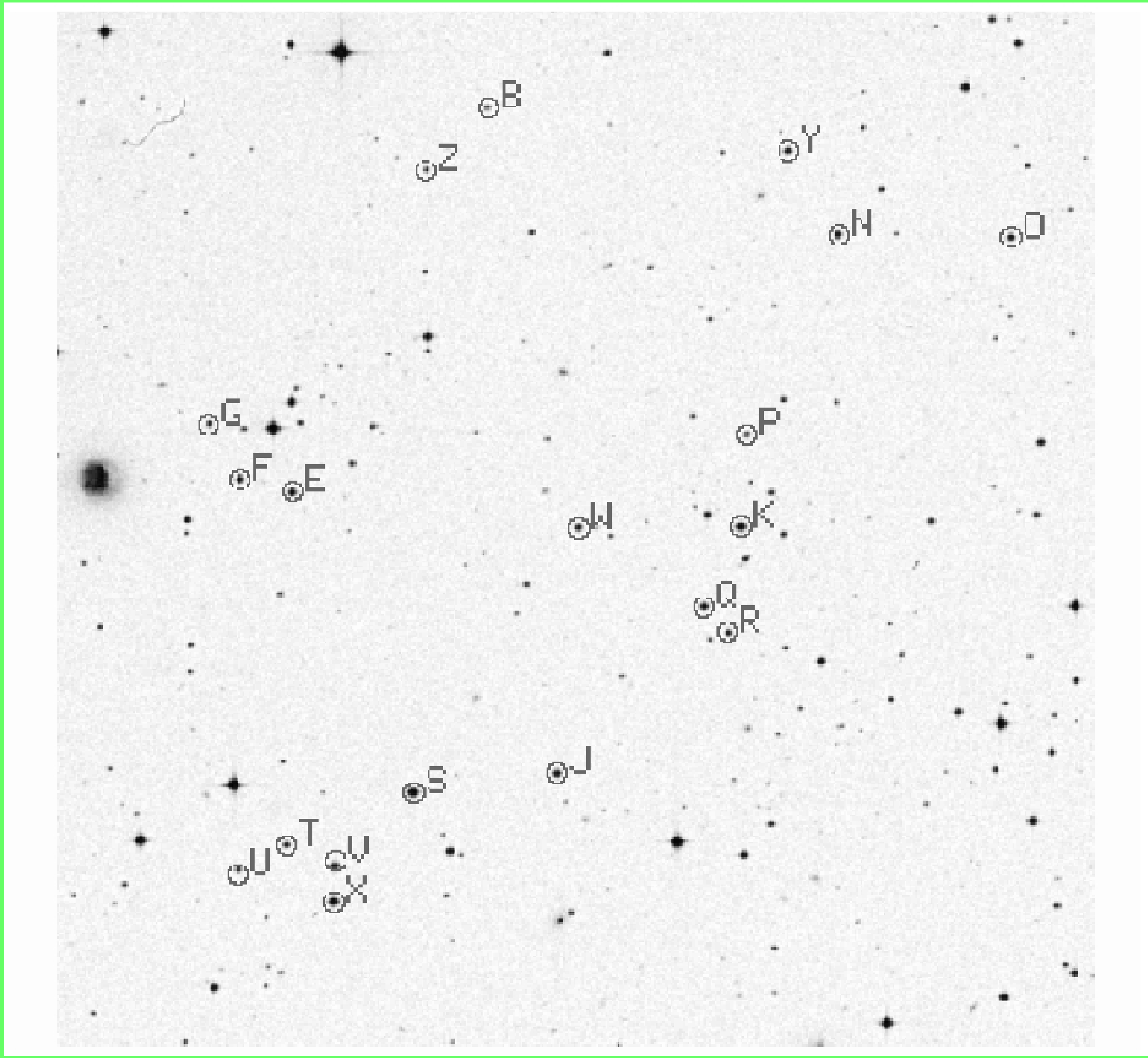
T is the transparency of a given pixel

A reference sequence of 23 stars present in the GSC2 catalogue near the source was established and aperture photometry was made with IRAF/APPHOT.

Instrumental magnitudes were transformed into B magnitudes on the scale of the GSC2 catalogue with a simple linear fit.

A further check was made using a CCD image from AFOSC at the 182 cm telescope of Cima Ekar.

Finding chart of WGA 0447-032 (Asiago Schmidt 67/90). The source is W, at center

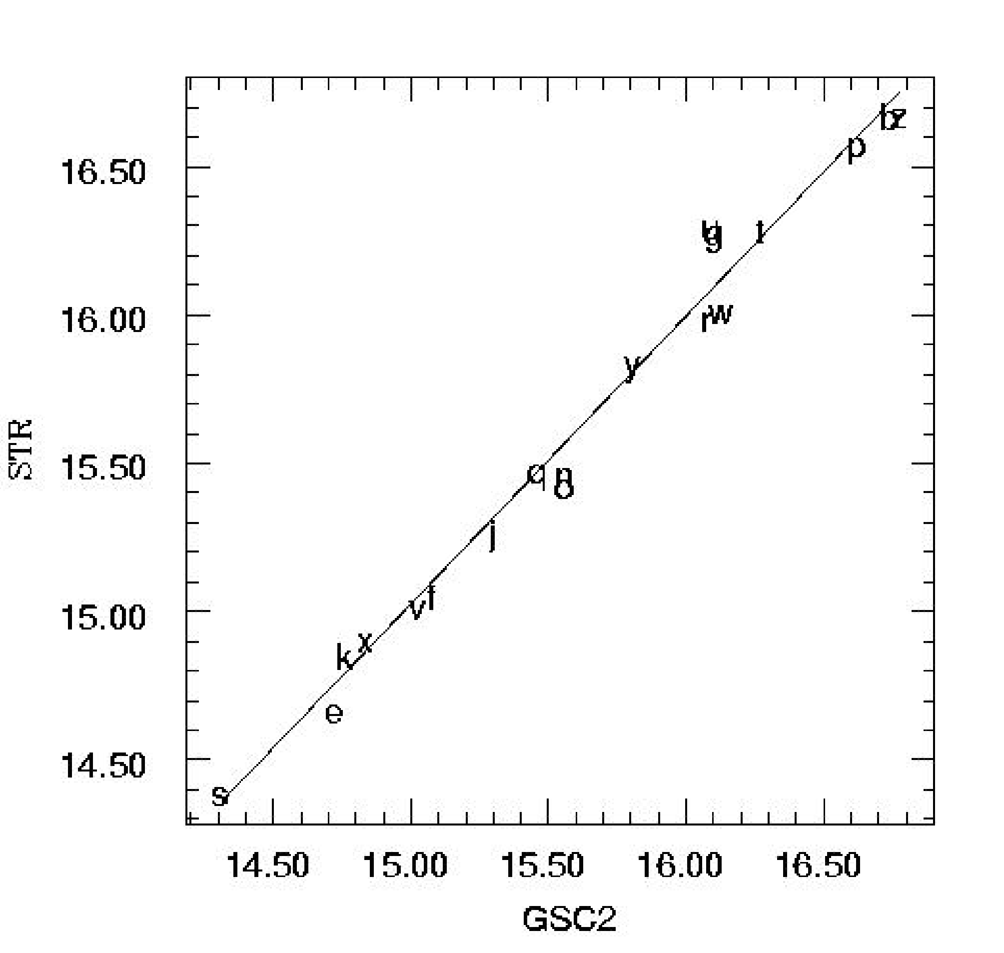


Example of calibration curve

- Fit with a linear relation.
- Letters are the labels of the reference stars

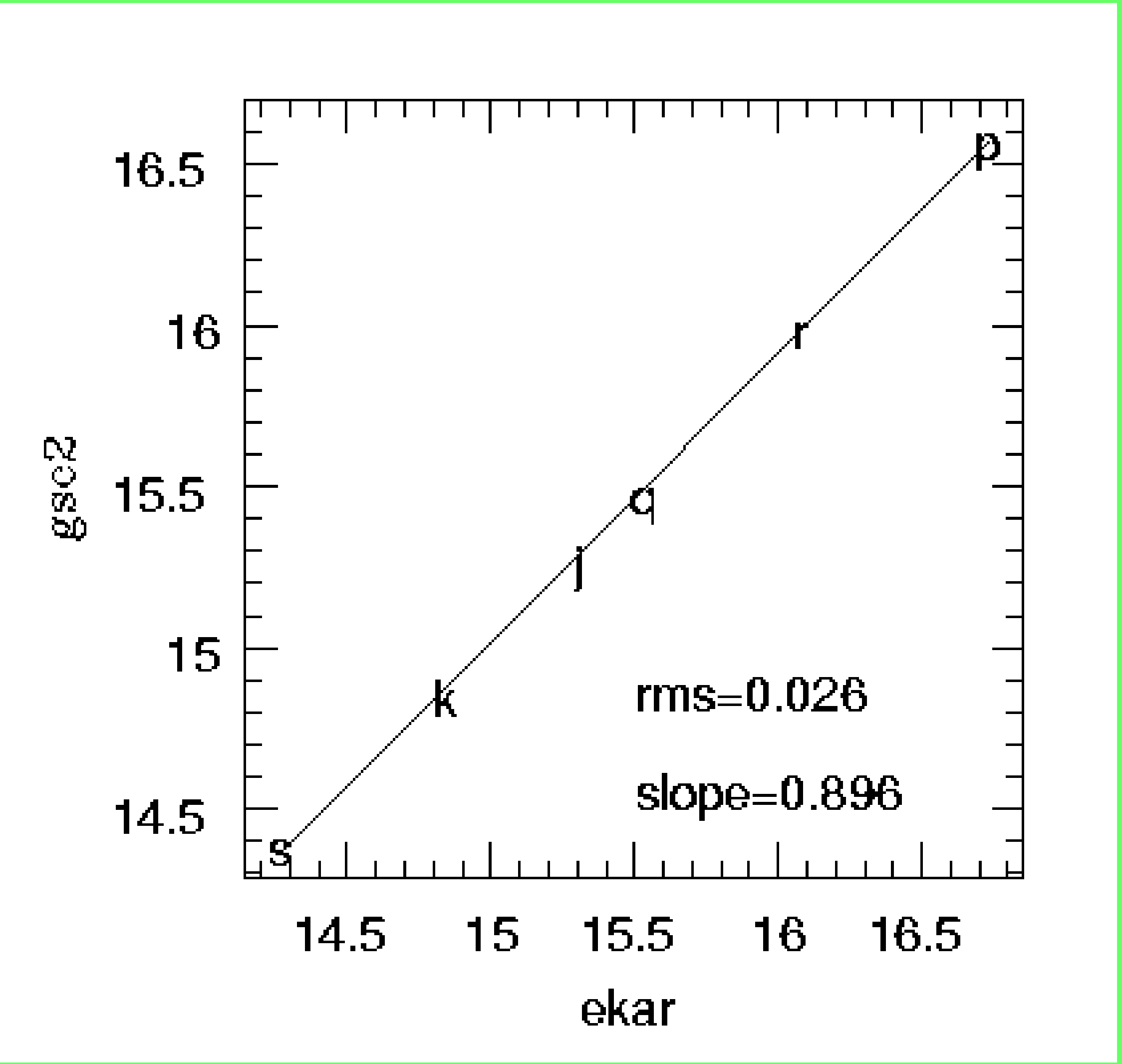
- Schmidt 67/90
- Slope range = 0.8 1.2
- Typical rms deviation = 0.08

- Schmidt 40/50
- Slope range = 0.8 1.3
- Typical rms deviation = 0.18



Linearity check

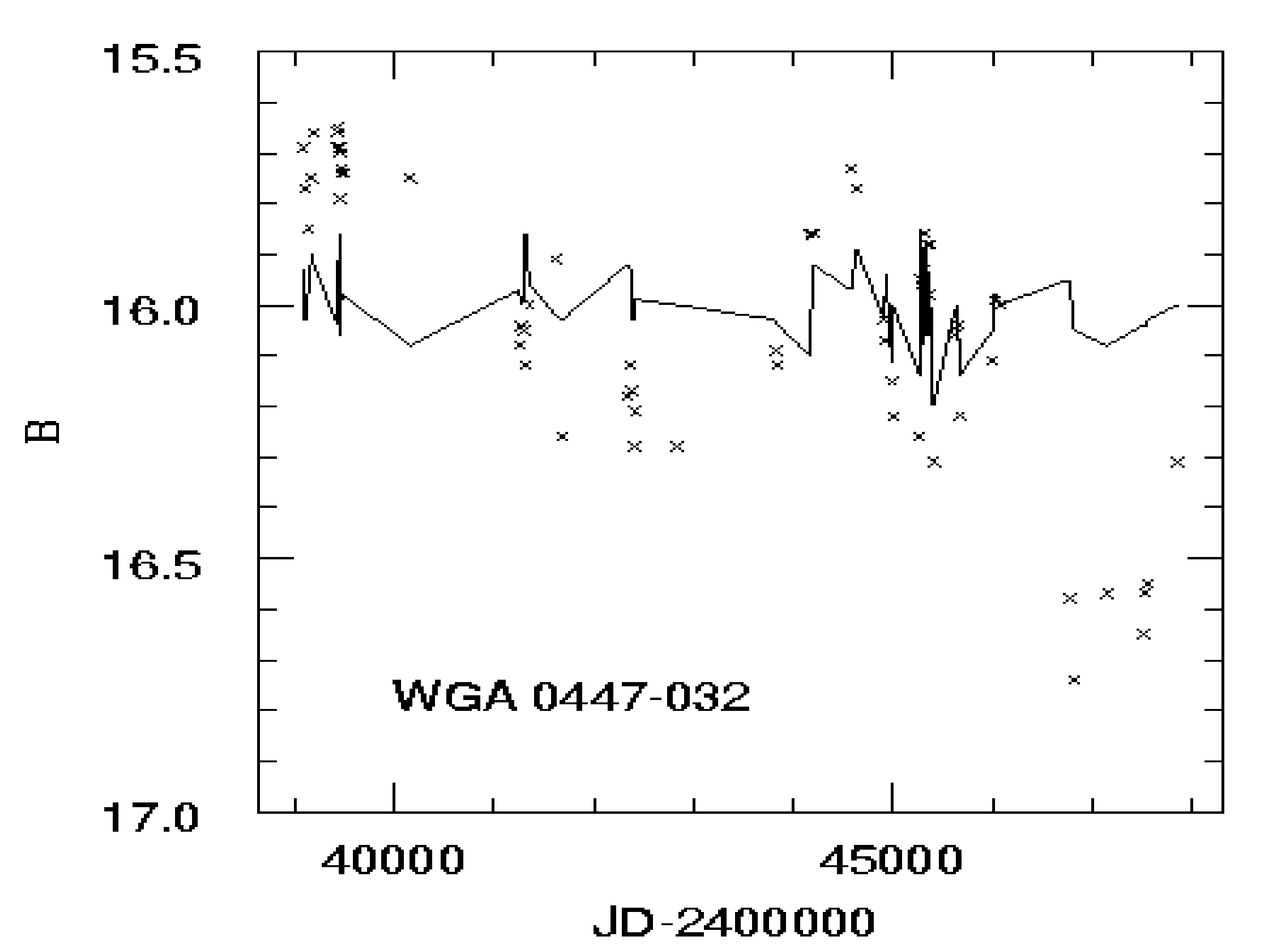
- Comparison of the GSC2 magnitudes with CCD photometry (B filter) with AFOSC at the 182 cm Ekar telescope: the slope is significantly shallower than 1.0



Light curve from the 67 cm Schmidt

X = QSO

Line = star r



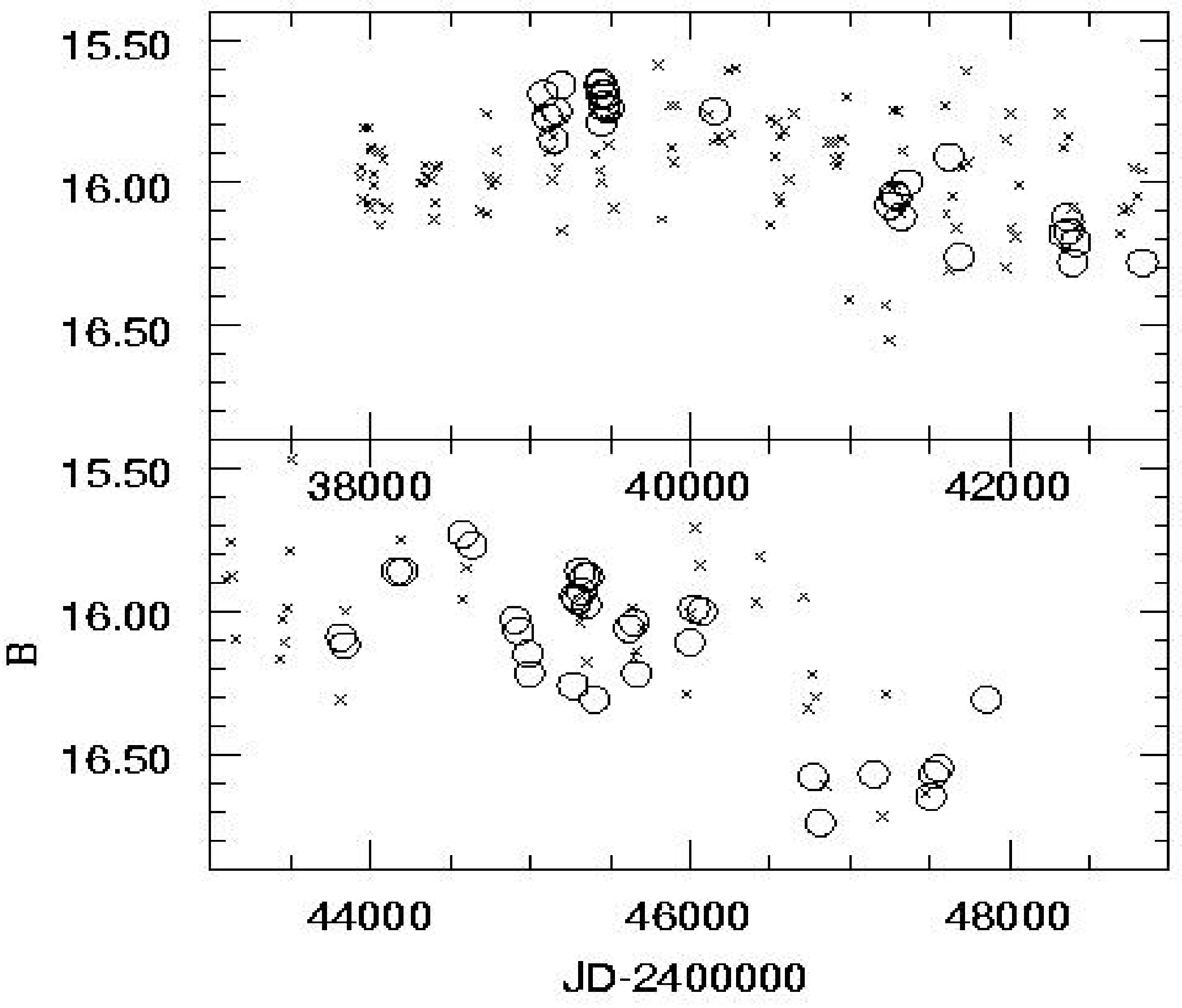
Historical light curve from both telescopes

circles: 67/90 Schmidt

crosses: 40/50 Schmidt

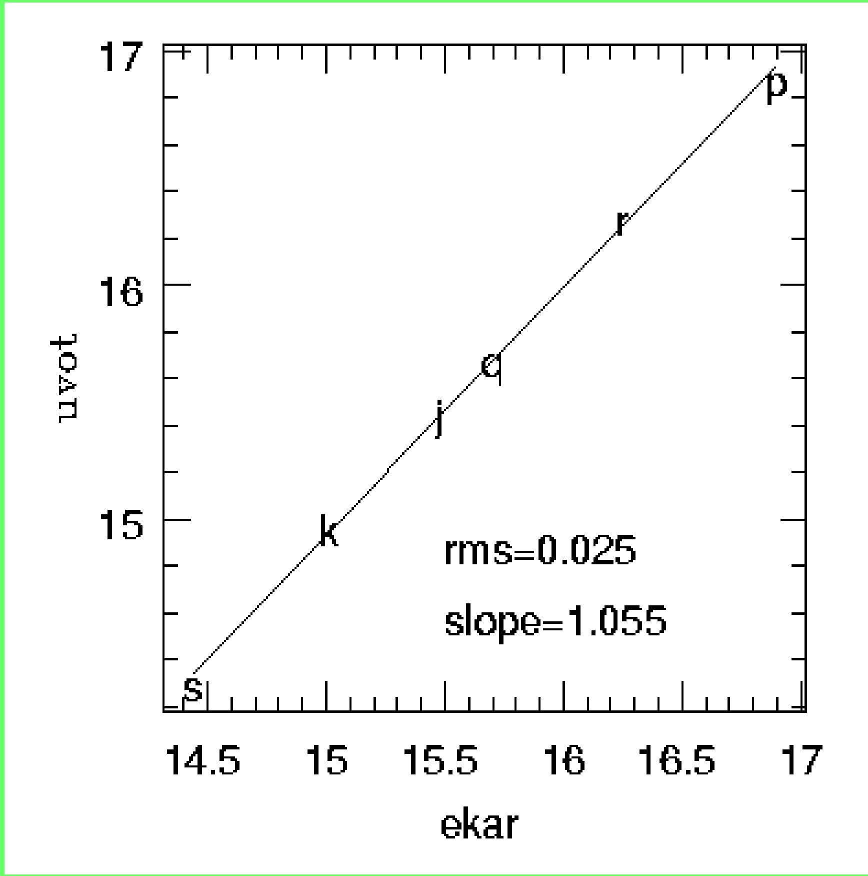
Time interval:

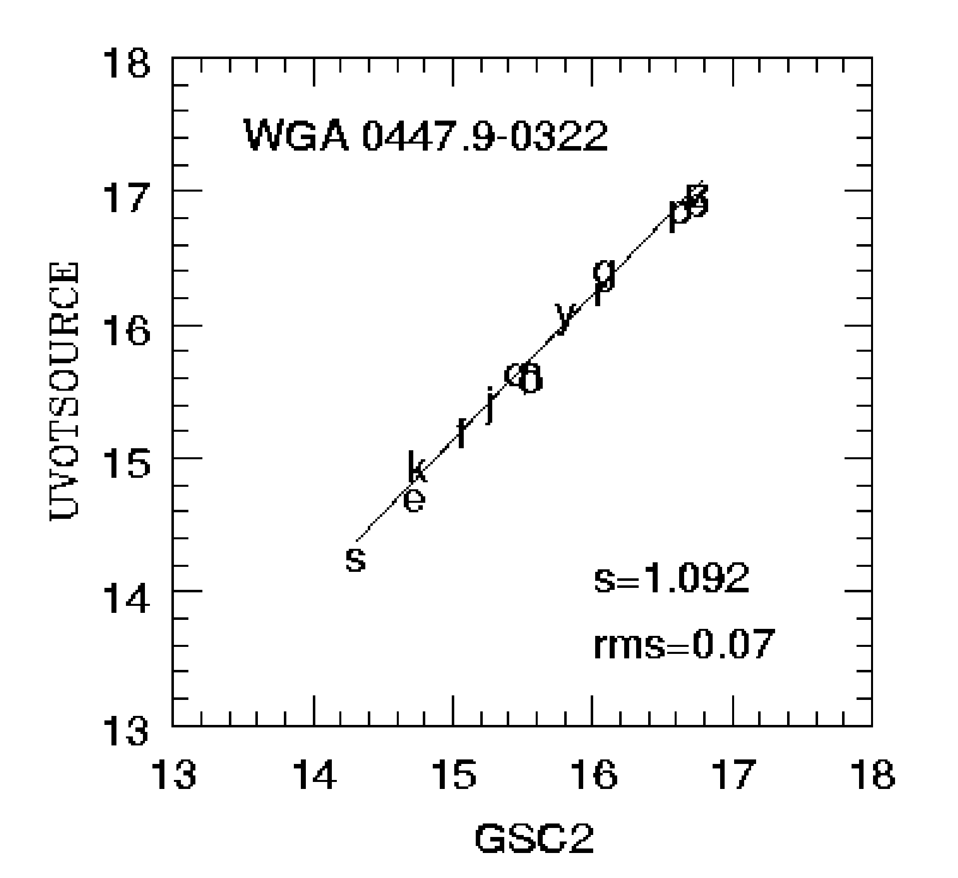
Sep 1962 - Jan 1991



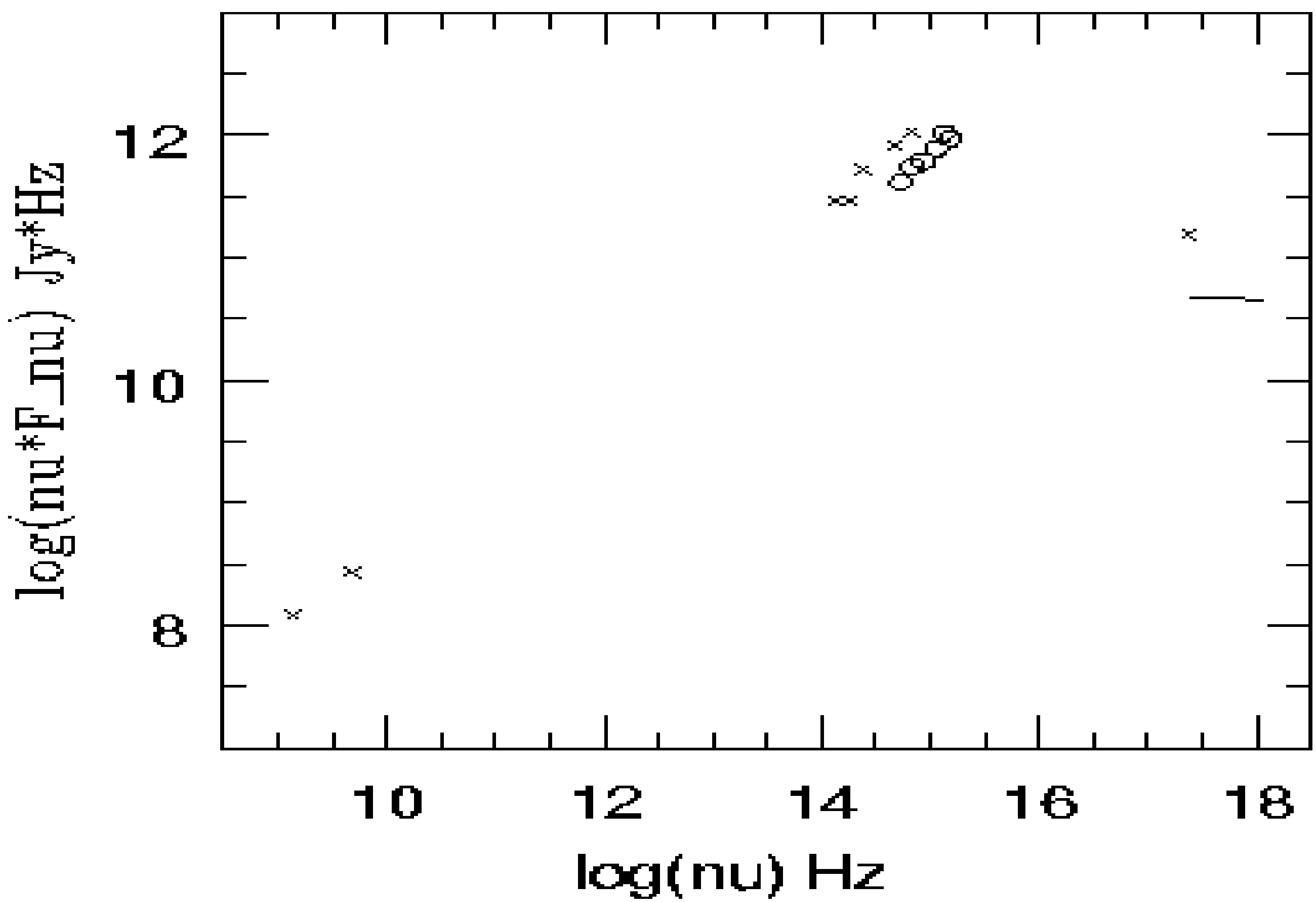
Photometry with SWIFT/UVOT

Observed by SWIFT in 2005 several times with XRT, but just one with UVOT in the 6 bands V,B,U,W1,M2,W2.





Spectral Energy Distribution (SED)



The light curve shape

- No large flares were detected in 29 years of monitoring
- The light curve may be interpreted as a monotonic decreasing trend of 0.11 mag/year, with faster oscillations of amplitude 0.3 mag.
- Extrapolating this trend up to now,the source should be around B=17
- UVOT observed it at B=16.6 (on the GSC2 magnitude scale).
- This winter it was still around B= 16.6 (Ekar). It is therefore around the same level of 1986.
- It can be a flare state over the decreasing trend, or it can be increasing after having reached a minimum value.
- Alternatively, one may think of a fast jump (half magnitude) form a higher to a lower state around the year 1986.

Discussion

- Some FSRQ have shown monotonic long term trends:
- Also several BL Lacs have shown long term trends: e.g. OQ 530, S5 0716+71, ON 231, OJ 287.
- the variability amplitude is within the range of the PG QSO sample (Giveon et al. 1999) and similar to that of HBL objects.
- The light curve of WGA 0447-032 looks therefore not much different from that of weak-lined HBL sources.
- The X-ray spectrum taken with SWIFT-XRT is rather flat, suggestive of an Inverse Compton component. A similar spectral slope was also detected with XMM-Newton by Giommi et al. (2005). The peak of the synchrotron component must be around 10^16 Hz, as is the case for many HBL objects
- The present X-ray flux is nearly half than in the WGA catalogue, while the optical flux is just about 0.3 mag fainter.