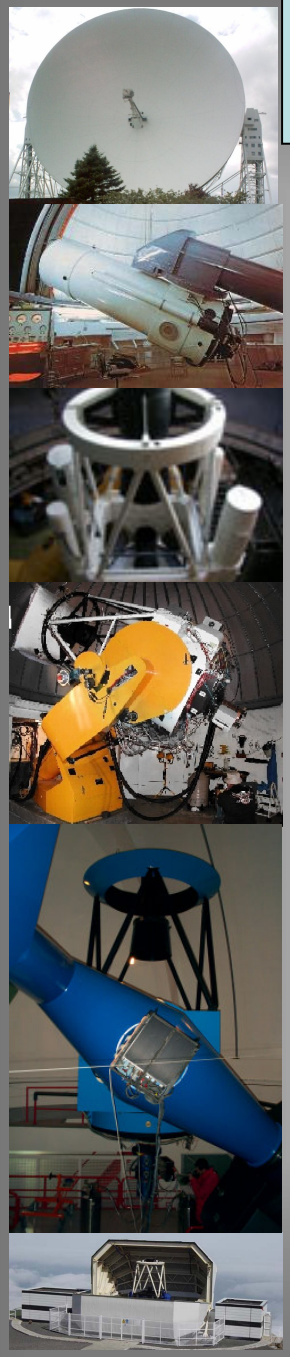

25 YEARS AFTER THE DISCOVERY: SOME CURRENT TOPICS ON LENSED QSOs

Santander (Spain), 15th-17th December 2004

Photometric monitoring of SBS 1520+530: long-term variability and microlensing

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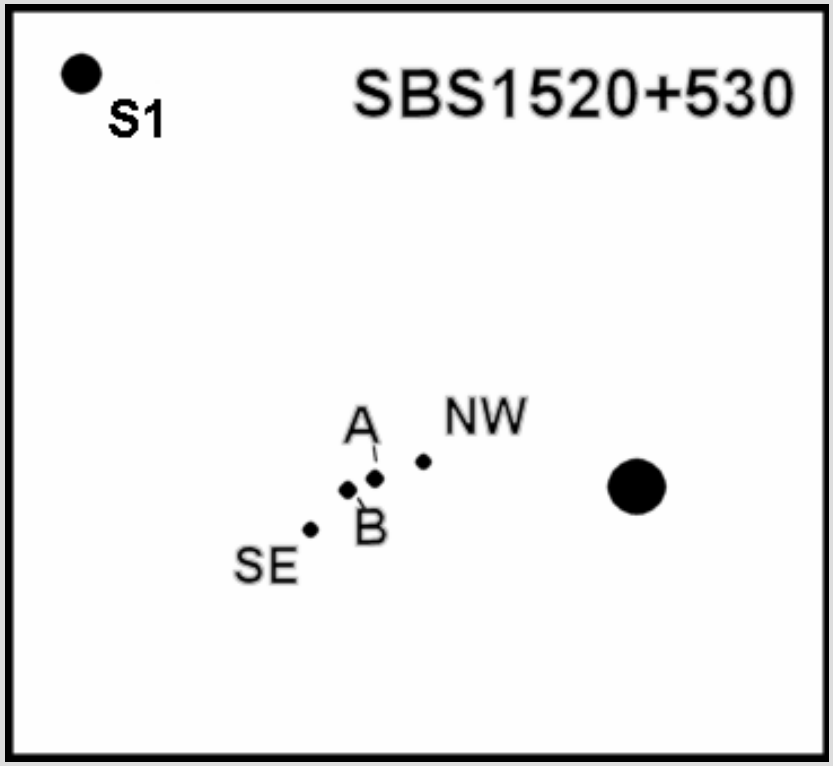
Gravitational lens system SBS 1520+530 and its neighbourhood

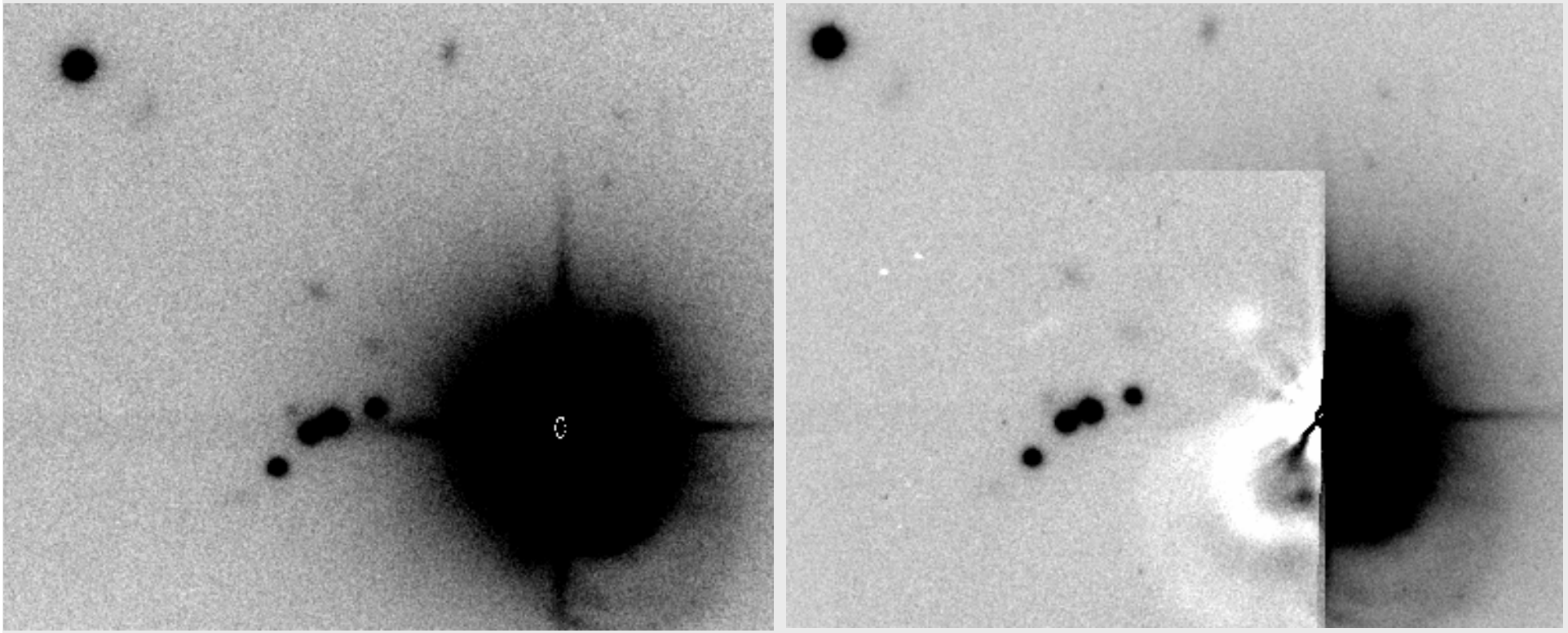
AZT-22 at Maidanak Observatory

Designation of objects in the field of SBS 1520+530

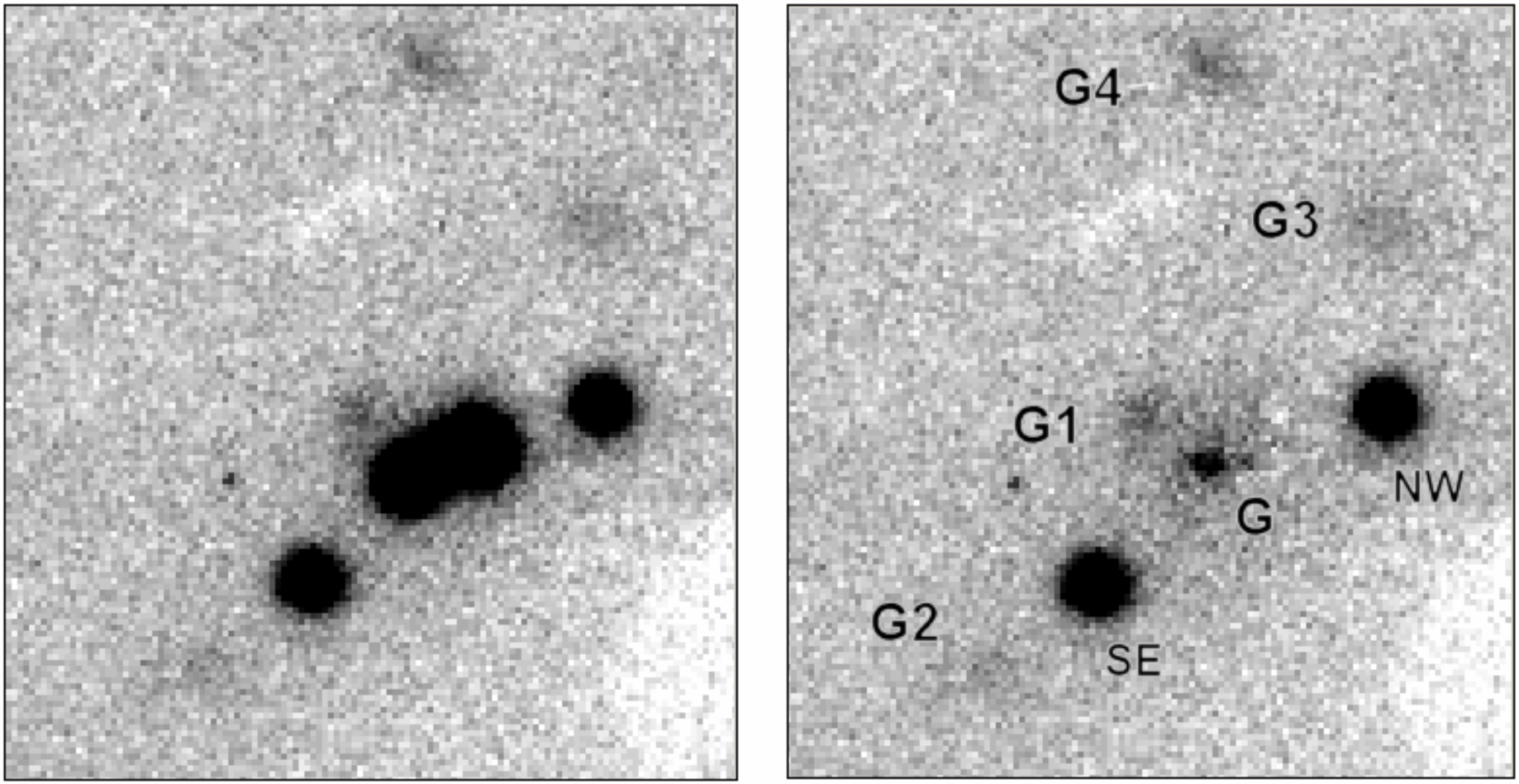


Photometry of reference star S1

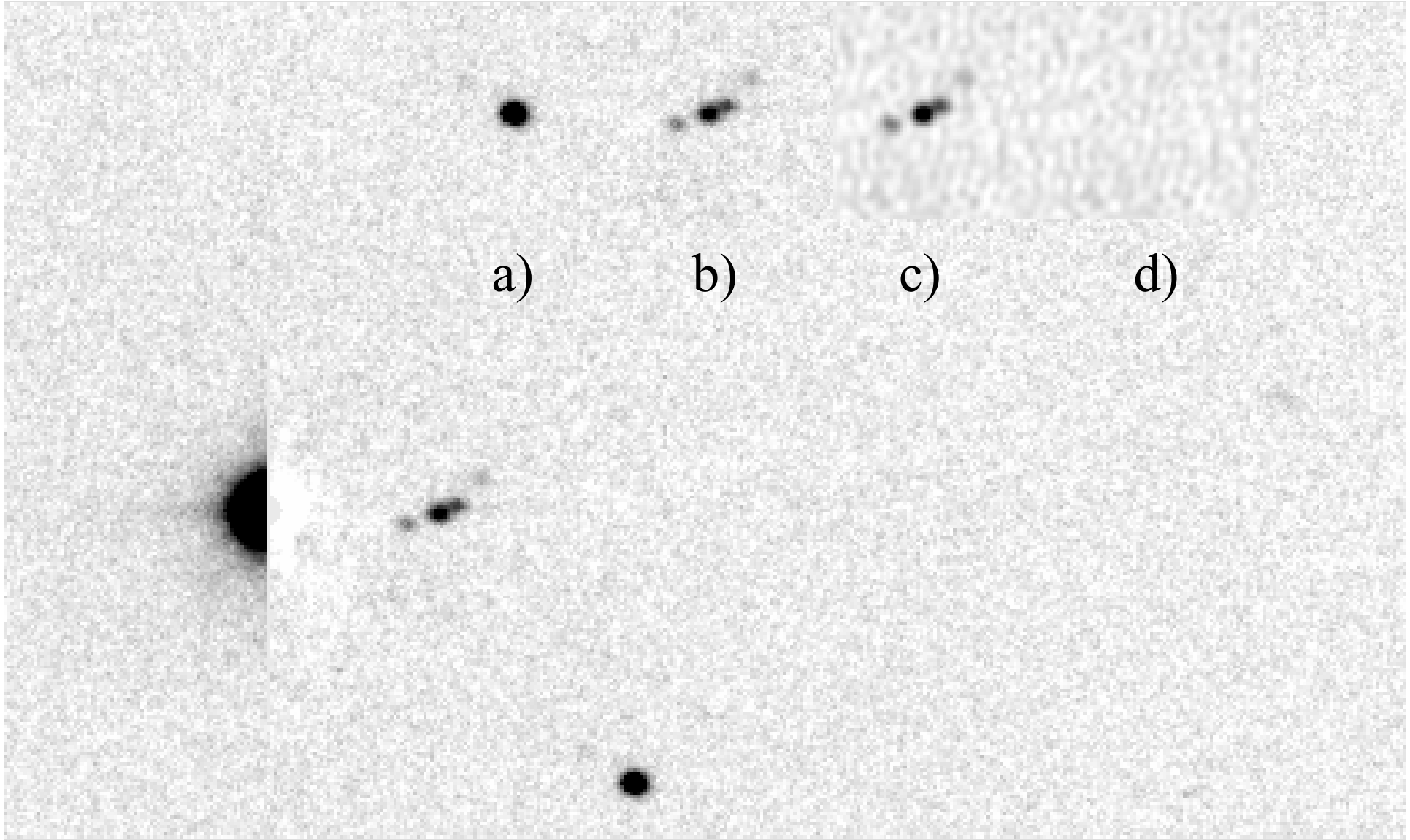
- $B=17.80^{m}\pm0.03^{m}$
- $V=17.37^{m}\pm0.02^{m}$
- $R=17.18^{m}\pm0.02^{m}$
- $I=16.93^{m}\pm0.02^{m}$



Left: averaged image of SBS1520+530 in I band (sum of 38 images with 300 s exposure each, seeing FWHM=0.65”); diffraction rays and scattered light from close neighboring bright star is seen; image cuts are chosen to contrast background variations. Right: the same image after applying procedures of diffraction rays subtraction and correction for the scattered light.

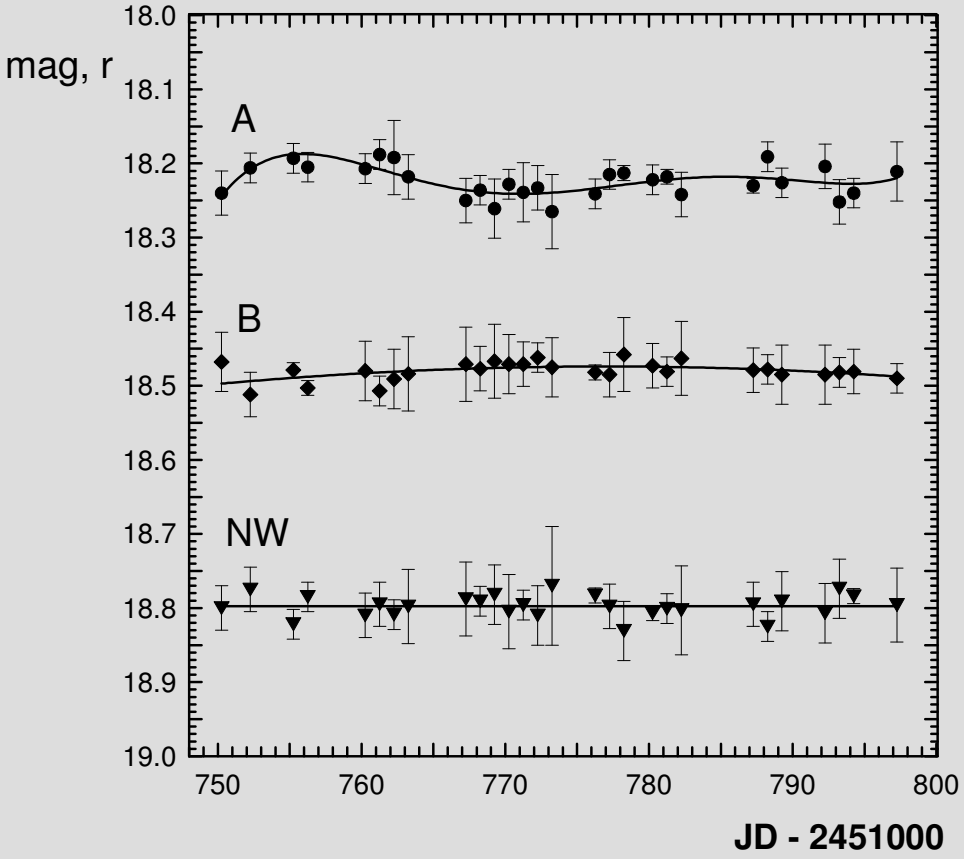


Right: A fragment of averaged image of SBS1520+530 in I band with diffraction rays and scattered light from the close bright star corrected. *Left*: The same image with A and B components subtracted. The lensing galaxy is denoted as G, neighboring field galaxies -as G1-G4



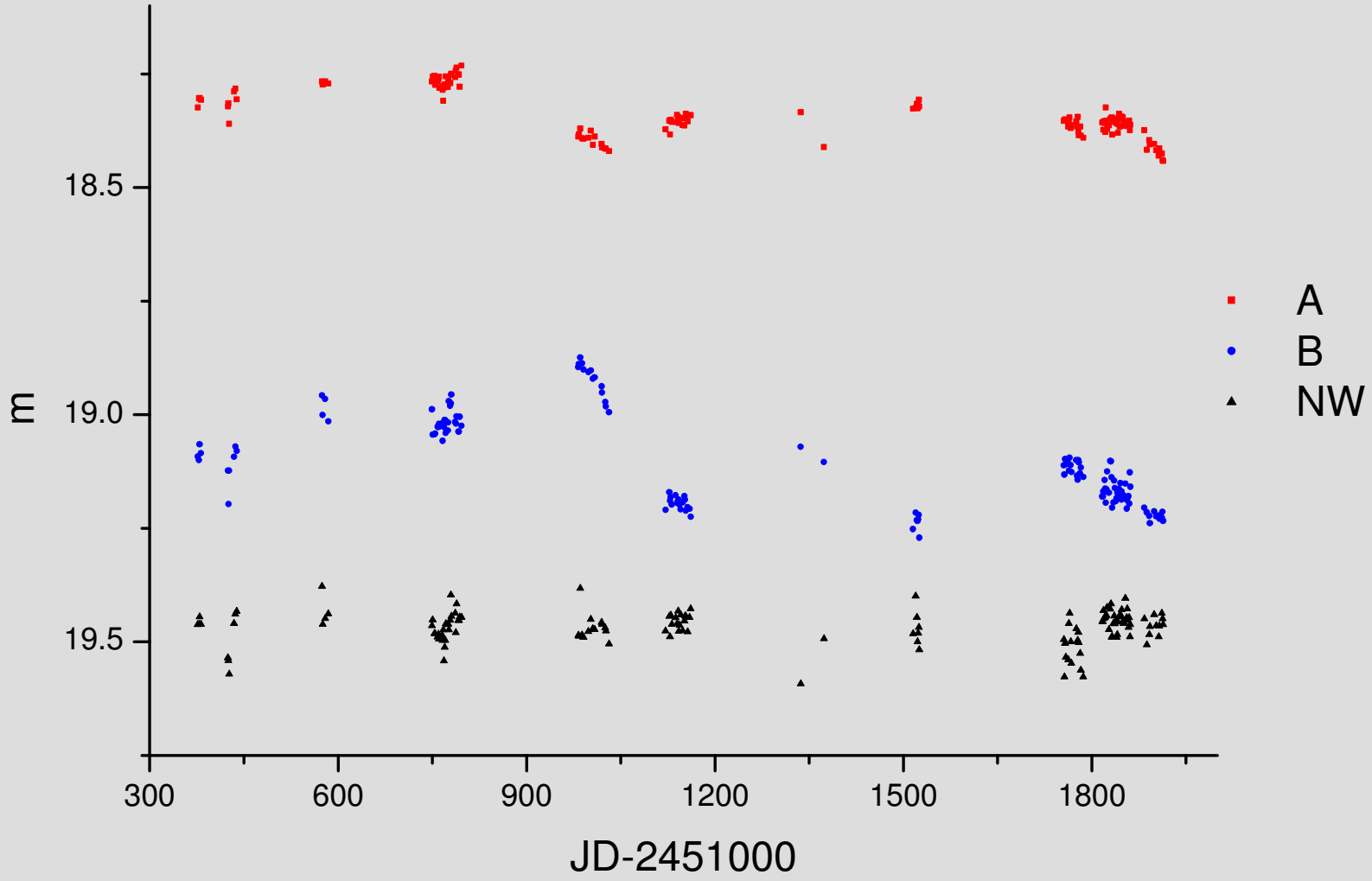
The work of the photometry routine: a) PSF Star; b) an initial image of object; c) the same image after applying a restoration procedure d) the result of subtraction of

The continuous monitoring (each clear night) in 2000

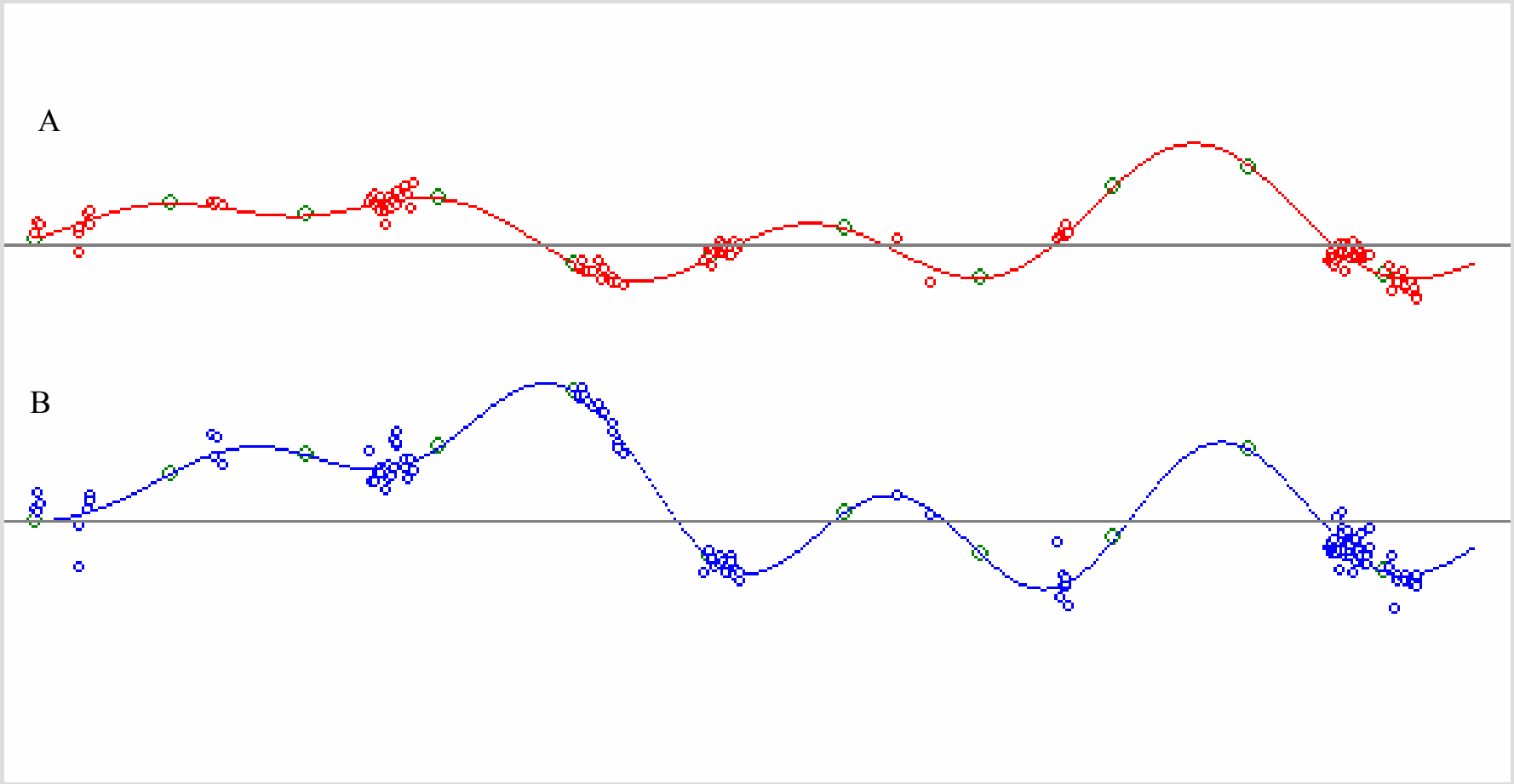


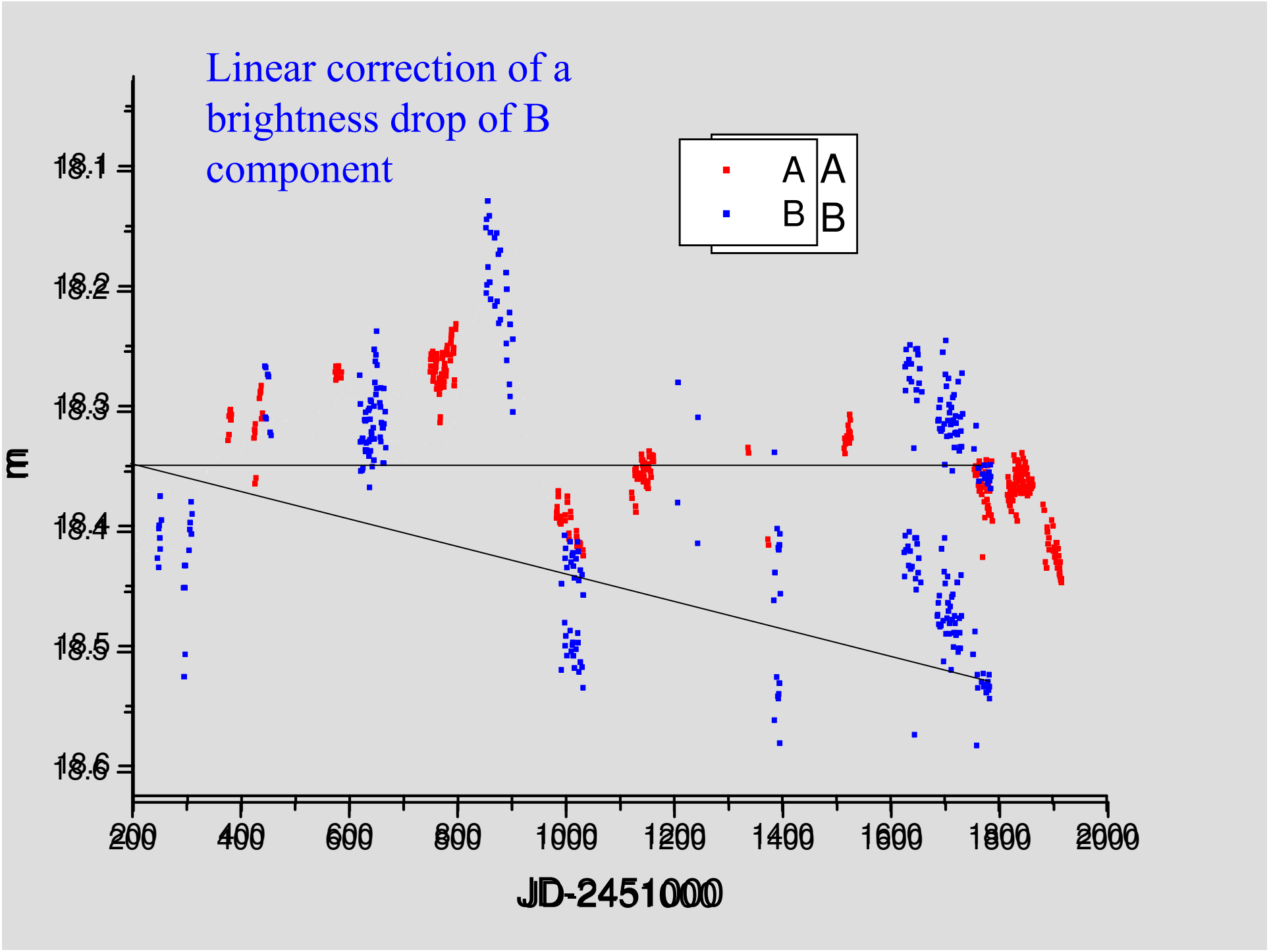
The variability of a component A on an interval of order of 10 days and amplitude 0.03m-0.05m is detected

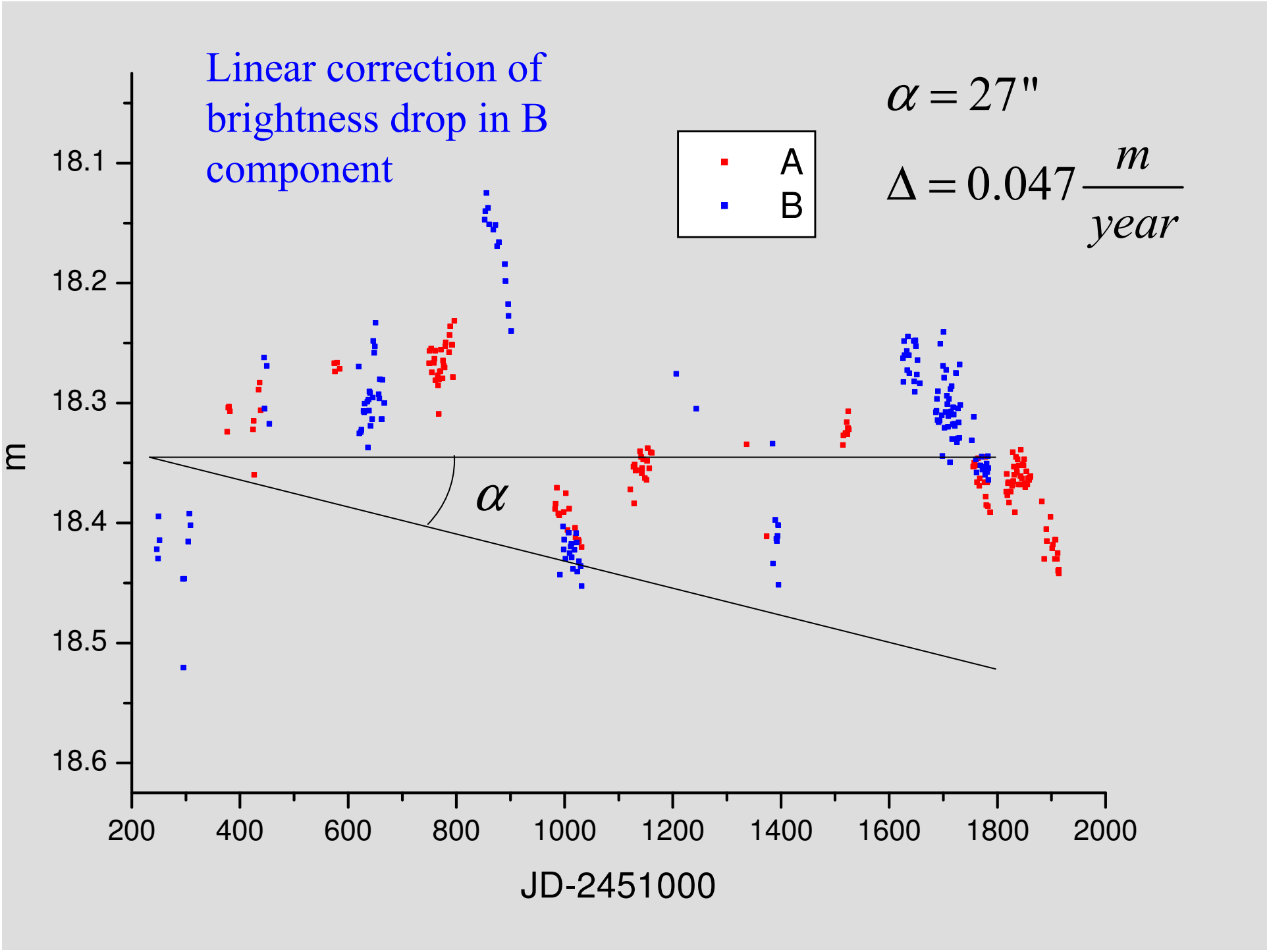
Historical light curves A,B components of SBS1520+530 and the star NW, including all the data obtained at Maidanak Observatory during 1999-2003.



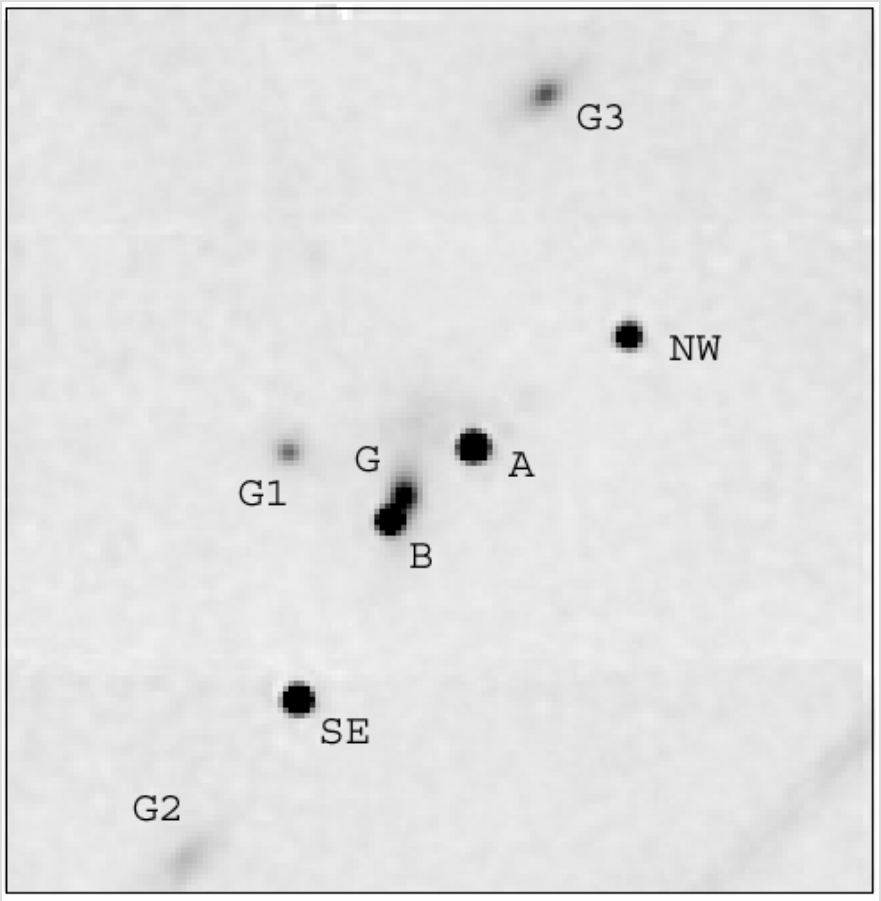
Fitting of a light curves of quasar components with a window equal 0.5 years




Linear correction of a brightness drop of B component
A
A
B
B
m
18.1
18.2
18.3
18.4
18.5
18.6
200
400
600
800
1000
1200
1400
1600
1800
2000
JD-2451000


Linear correction of brightness drop in B component
$\alpha = 27''$
$\Delta = 0.047 \frac{m}{year}$
A
B
α
m
18.1
18.2
18.3
18.4
18.5
18.6
200
400
600
800
1000
1200
1400
1600
1800
2000
JD-2451000

Restored HST Image of SBS 1520+530



Measured relative coordinates of objects in SBS 1520+530 relative to A :

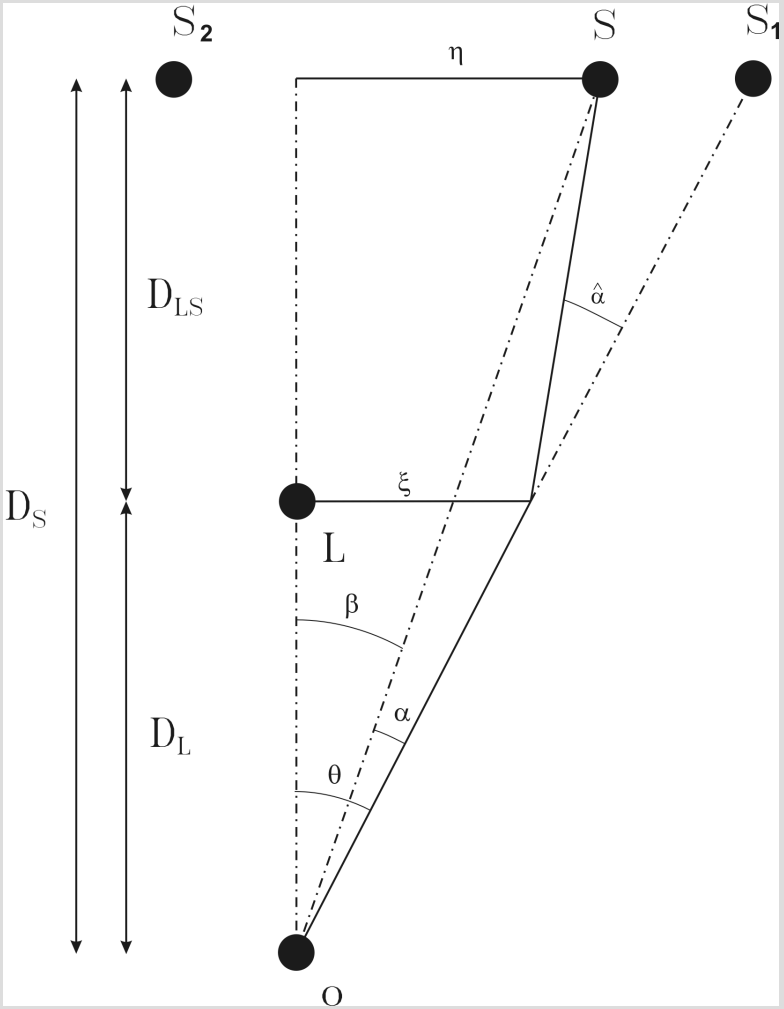
B $\Delta\alpha = 1.429''$
$\Delta\delta = -0.652''$

G $\Delta\alpha = 1.141''$
$\Delta\delta = -0.395''$

The axis ratio: $e = 0.50 \pm 0.01$

Position angle: 61 ± 5^{o}

Parameters of the SBS 1520+530 obtained from the modeling SIS+ γ



$$\Omega_\Lambda = 0.7,\ \Omega_M = 0.3$$

$$H = 75\frac{km}{c \cdot Mpc}$$

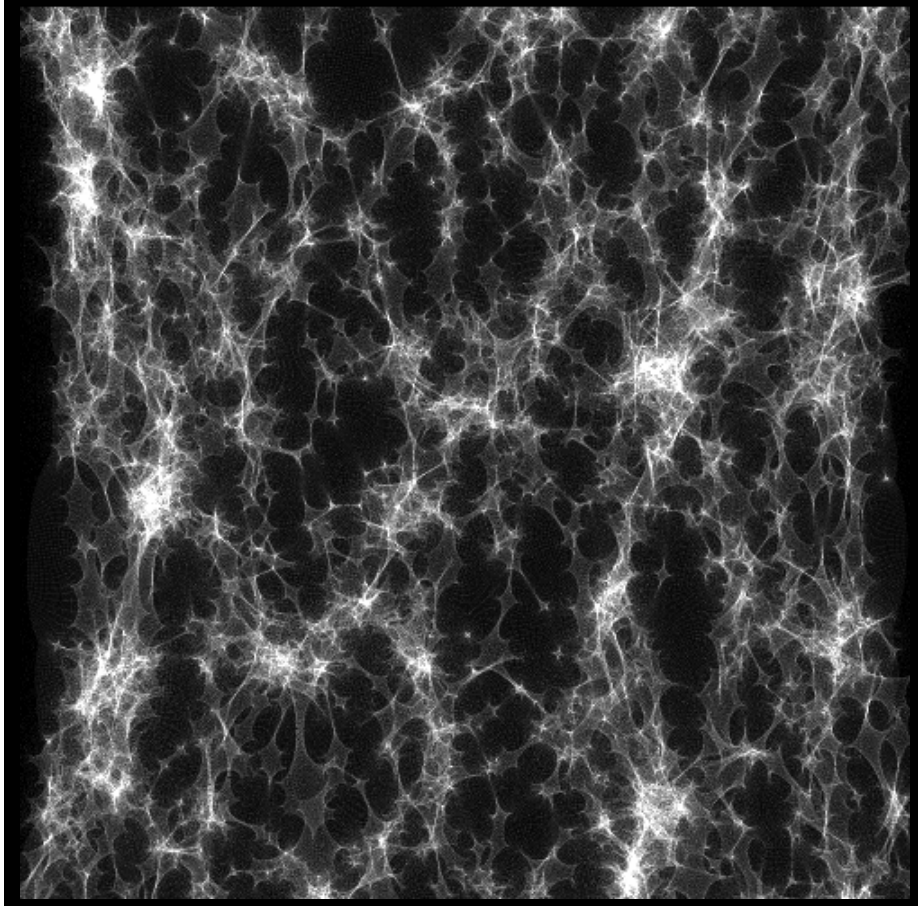
$$D_L = 1389 Mpc, D_{LS} = 789 Mpc,$$

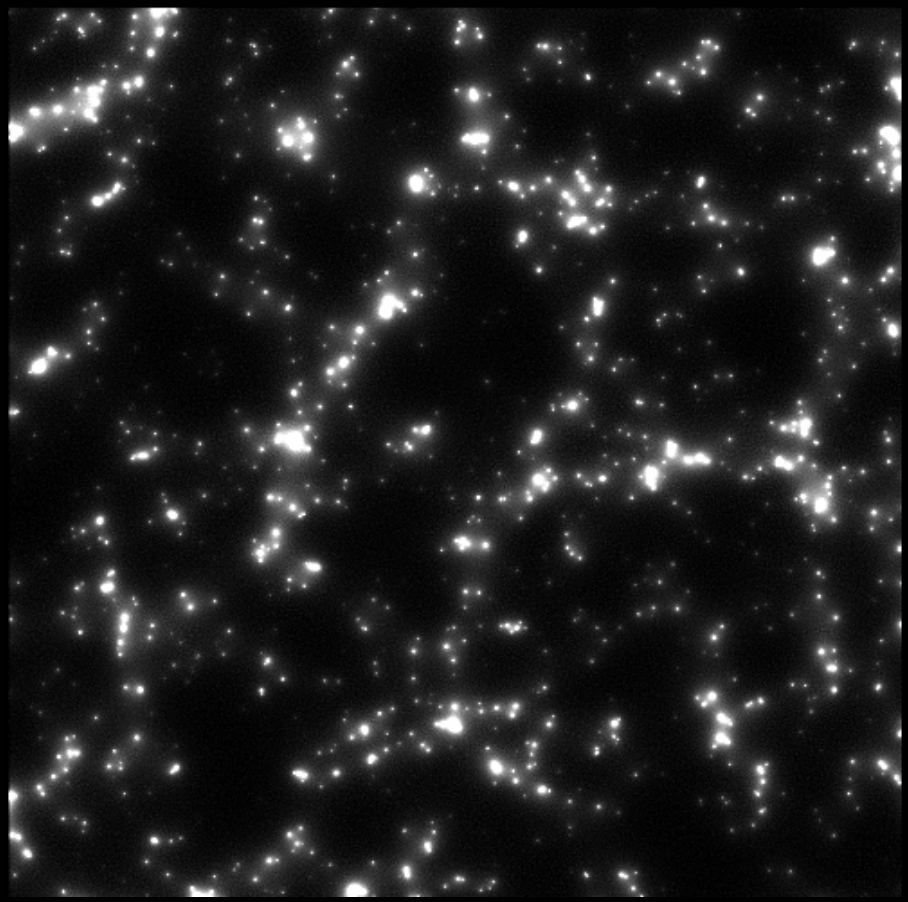
$$D_S = 1624 Mpc$$

$$\theta_E = 0.815'' \qquad \sigma_v = 241\frac{km}{c}$$

$$\gamma = 0.1$$

Modeling of a caustic pattern near A,B components of SBS 1520+530



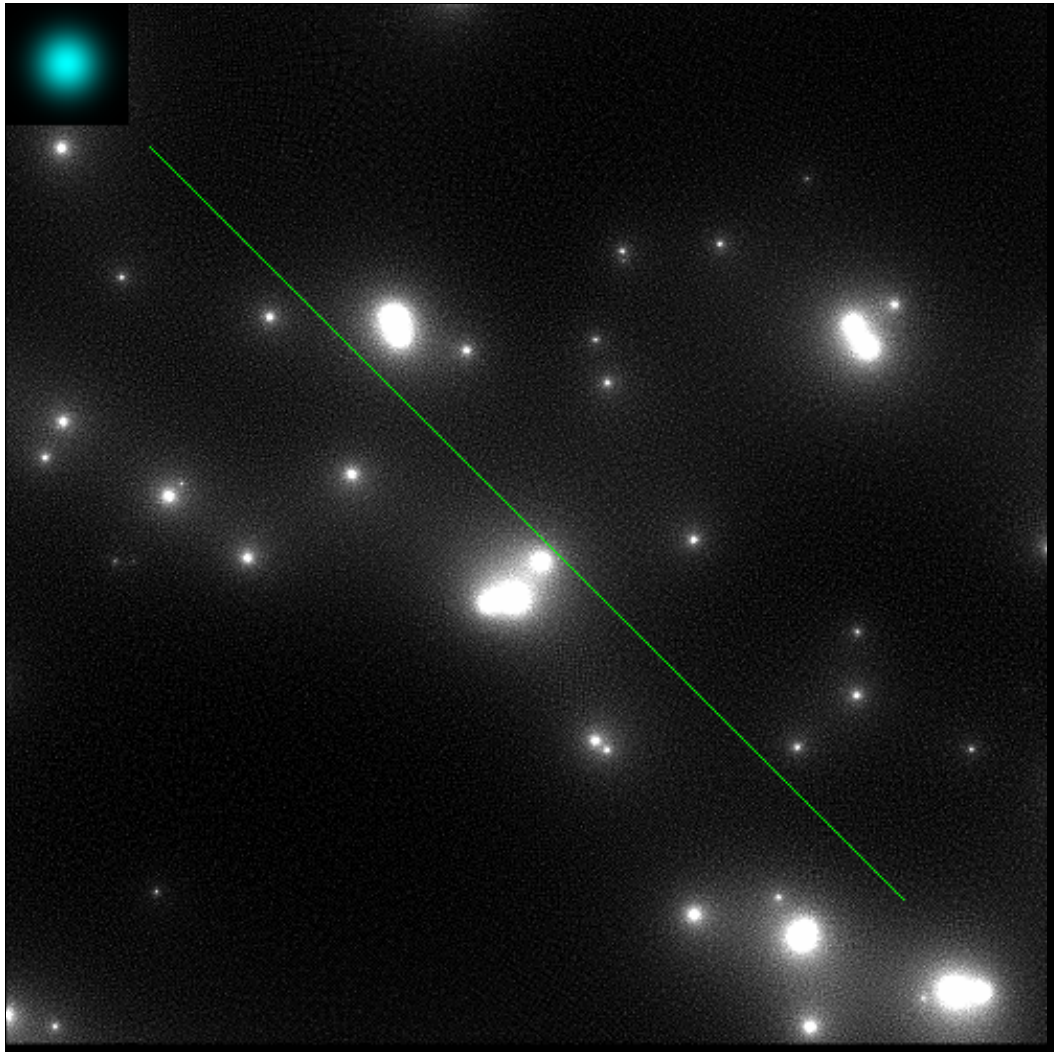


A

$\kappa \approx 0.34,\ \gamma = 0.1$

B

$\kappa \approx 1,\ \gamma = 0.1$



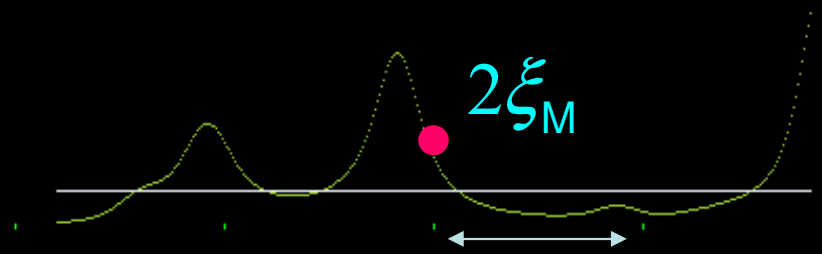
Einstein radius of solar mass

$$\theta_{\mathrm{M}} = 2 \cdot 10^{-4}\, arc\,\mathrm{sec}$$

$$\xi_{\mathrm{M}} = 4.1 \cdot 10^{14}\, m$$

If suppose :

$$v_{trans} = 1000 \frac{km}{c}$$

then an estimate of the time of Einstein ring crossing:

$$\Delta t \approx 25\ years$$