Four Gravitational Lens Candidates in the HST Snapshot Survey of BL Lac Objects.

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In our HST survey of BL Lac objects (Urry *et al.* 1999; Urry this conference; Falomo *et al.* 1998, this conference) we have found 4 gravitational lens candidates (see Fig. 1). Three sources, 0033+595, 0502+675 and 1440+122, are close-separation doubles suggesting they may be splitted by gravitational lensing by a foreground object. A possible lensing galaxy is detected in 2 cases. The fourth gravitational lens candidate, 1517+656, is surrounded by three arcs and may be an Einstein ring.

Double sources. Present data can not rule out chance alignment of a star with the BL Lac object. However, both the very low density of objects elsewhere in the images and the small angular separation ($1.''6$, $0.''3$, and $0.''3$) argue that at least some of this candidates are either a double nuclei, or true lens images. Also in one case where we have color information, the two point sources have the same R-H color.

The redshift distribution of the 97 BL Lacs surveyed peaks below z$\sim$ 0.5, where the probability of chance lensing by foreground galaxies is quite small. Comparing to quasar survey (e.g. Kochanek 1996, Maoz et al. 1993), and allowing for our lower mean redshift, we would expect $\ll 0.4$ lenses in our BL Lac sample. We have 3 candidates.

If all three are confirmed, the frequency of 1 in 30 would be a very unexpected result, possibly related to the reported overdensity, by a factor of 4-5, in the number of MgII absorption system detected in the spectra of BL Lacs relative to quasars (Stocke & Rector 1997).

Einstein Ring. The fourth candidate, 1517+656 at z>0.7, is surrounded by three arcs and in this case the BL Lac and its surrounding massive host galaxy may be lensing a background object (Fig. 1).

BL Lacs are among the most rapidly and largely variable AGN known. If confirmed as lenses, the double sources are good tools for estimating H_0 via gravitational time delay, while the almost perfectly circular arcs surrounding 1517+656 may permit a good determination of the mass and mass distribution of the lensing galaxy. Follow-up spectroscopy and deep imaging are clearly required to investigate the true nature of our candidates.

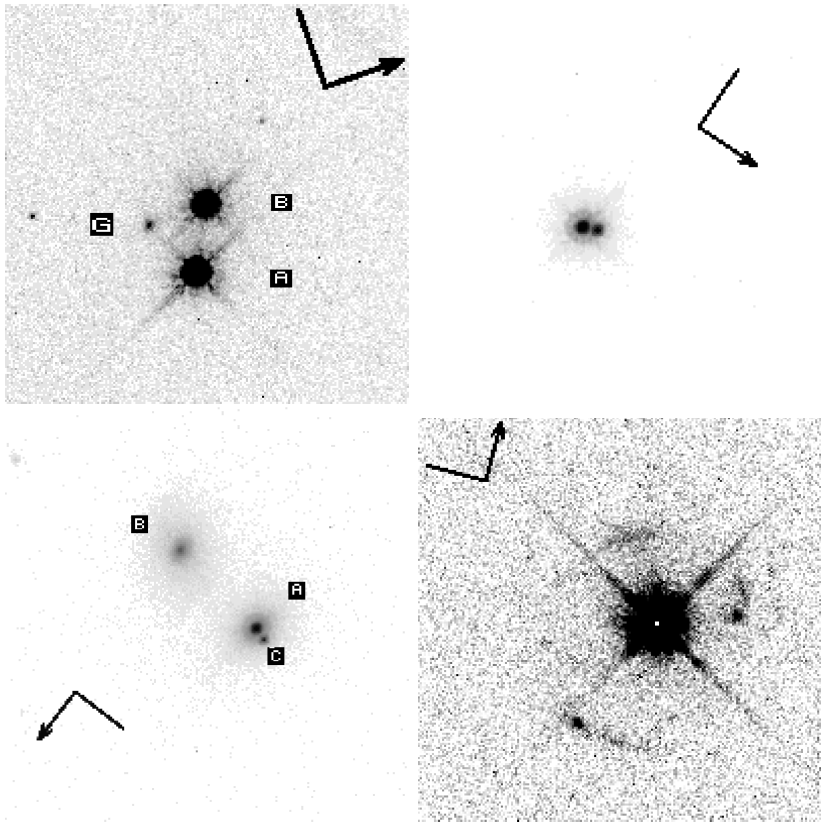

Figure 1. WFPC2+F702W image of the 4 gravitational lens candidates. North and east are marked. **Upper left:** The two components of 0033+595, with magnitude $R_A = 17.7$ and R_B =18.1, are separate by $1.''58$. A small $R_G \sim 22.4$ galaxy is also detected. **Upper right:** 0502+675 is resolved into two point sources $0.''33$ apart, with magnitudes $m_R = 16.4$ and 17.9. Comparing the average radial profile of both sources with a PSF model reveals the presence of a galaxy as well. **Lower left:** 1440+122 is resolved into two large elliptical galaxies separate by $2.''53$. The rightmost (A) is the BL Lac counterpart, which has two bright point sources (m_R=17.8 and 19.8) located at its nucleus, separated by $0.''29$. **Lower right:** 1517+656 is surrounded by 3 arcs describing a circle with radius $2.''4$ and surface brightness $\mu_R \sim 22.4\ mag/arcsec^2$.

References

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