TWO VISUAL OBSERVATIONS OF RELEVANCE TO THE
SEARCH FOR OPTICAL COUNTERPARTS OF GAMMA-RAY
SOURCES

(Letter to the Editor)

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Abstract. We draw attention to a visual observation of a brief flash from ζ Lyrae, observed by Heis in 1850, which resembles the optical burst detected electronically by Wdowiak and Clifton (1985) from β Cam in 1969.

Visual observation by the author of a second magnitude flash of very short duration is shown to originate from planar reflection from a very distant satellite. Such flashes will contribute to the 'noise' in all-sky searches for optical counterparts of γ-ray bursters.

1. Introduction

The discovery on archival patrol plates of a probable optical flash on 17 November, 1928 (Schaefer, 1981), coincident in position with a known γ-ray burster, followed by two more instances for other bursters (Schaefer et al., 1984), has opened an era of searches for optical transients. The first of the above flashes is estimated to have reached $m_v \sim 3$ with a duration $\sim 1$ s, bringing observation of such phenomena well within reach of the naked eye. Already there are claims of visual observations of a transient optical source in Aries (MacRobert, 1985a, b), not all with concordant positions. Furthermore, there is the first electronic detection of an optical flash – the brightening of the image of the double star β Cam by $\sim 1$ mag with a duration $\sim 0.25$ s, as recorded by an intensified SEC Vidicon used for observation of meteors (Wdowiak and Clifton, 1985). Considerable effort is being expended (Ricker et al., 1984; Teegarden et al., 1984) in preparation for wide-field searches for optical transients, which should lead not only to correlations between the optical and γ-ray bursters, but will undoubtedly uncover new phenomena and will also be troubled by 'noise' from extraneous flashes.

In this note I draw attention to an archival visual observation analogous to that of the brightening of β Cam, and to a contemporary visual observation which illustrates the need for care in interpreting transient optical events.

2. An Optical Burst in the Double Star ζ Lyrae

Hagen (1903) discussed historical observations of a number of 'temporary stars' in which he drew attention to an observation by Eduard Heis of a temporary brightening of the star ζ Lyr on 26 September, 1850. In Hagen’s words “Heis observed (with
unaided eye) the variable star $\beta$ Lyrae from 1841 to 1868, and used as comparison stars, among others, $e$ and $\zeta$ Lyrae. Each of these has the magnitude 4.5, but appears double to the naked eye on very clear nights. Heis found the relative brightness of these two comparison stars slightly changeable. On the date mentioned the observing book... has the following note: $\zeta$ Lyrae became for a moment very bright, and then again faint.

"The star probably did not reach the brightness of the neighbouring first-magnitude star $\alpha$ Lyrae, else Heis would hardly have omitted the comparison. The time of the fluctuation must have been too short to be measured, because Heis was in the habit of recording the time in whatever he observed.

"The short note deserves the more confidence, as Heis had been familiar with this comparison star for nine years; further, as his eyes saw the stars as distinct points without false rays...., and finally as his observations of variable stars show a rare precision in estimating steps."

It is perhaps worthwhile to add further that Heis was a prolific observer of variable stars over many decades; he was a close friend of Argelander, and he produced, five years before his death, the star chart *Atlas Coelestis Novus*, published in Köln in 1872. Furness (1915) chose to illustrate her book with several of Heis's light curves and comments that he had "remarkably clear sight... Even in his old age he was accustomed to say that he saw the stars as sharp points without any rays... Heis's observations were made largely with the unaided eye, opera glass or a small comet-seeker...". There seems no reason, therefore, to mistrust Heis's claim that $\zeta$ Lyr showed a significant momentary brightening.

### 3. Properties of $\zeta$ Lyrae

$\zeta$ Lyr ($\alpha_{1950} = 18^h 42^m 30^s = 280^\circ 6$, $\delta_{1950} = 37^\circ 38' = +37^\circ 6$) is a visual, physical double (ADS 11639) whose components are separated by 43.8. Heis's observation of an optical brightening could have referred to either of the components.

$\zeta^1$ Lyr (HR 7056, HD 173648) is a suspected variable star (Kukarkin *et al.*, 1982) with range $4.31 \leq V \leq 4.37$ and spectral type Am. It is a single-line spectroscopic binary (Batten *et al.*, 1978) with a period 4.2999 days.

$\zeta^2$ Lyr (HR 7057, HD 173649) is a suspected variable star with $5.68 \leq V \leq 5.74$, spectral type FOIVv and listed by Hoffleit (1982) as a spectroscopic binary without known orbit (presumably on the basis of the radial velocities in Abt and Biggs, 1972).

There is a suspicion of greater variability than indicated above because Johnson (1901) states that whereas some observers had recorded up to $2\frac{1}{2}$ mag difference between the two stars, he found only $1\frac{3}{4}$ mag, between them. At present the difference is 1.3 mag and there is no colour contrast to account for variations between observers.

The evolutionary status of the system $\zeta^1, \zeta^2$ Lyr is not clear. Treated as single stars, with absolute magnitudes determined from photometry or spectroscopic classifications, they do not jointly fall on an isochrone (e.g., Corbally, 1984). Isochronism can only be achieved if one or both of the stars is an unresolved double with almost equal components. As $\zeta^1$ Lyr is a well-studied single-line spectroscopic binary this leaves only $\zeta^2$ Lyr as the possible miscreant. In this case, as we are looking for a possible neutron