# INVESTIGATION OF THE OPTICAL VARIABILITY OF GRO J0422+32.

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## 1. Observations

Nova Per 1992 was observed in 1992–94 on the 6 m and 1 m telescopes at the Special Astrophysical Observatory (SAO) of the Russian Academy of Sciencies and on the 1.5 m telescope at the Bologna Astronomical Observatory (Italy). The apparatuses used were a TV spectrum scanner with the hard/software photometrical system MANIA (Multichannel Analysis of Nanoseconds Intensity Alterations) complex with a time resolution of $10^{-7}$ s [3] (on the 6 m telescope), a CCD photometer (on the 1 m telescope) and a double head fast photometer (on the 1.5 m telescope) [5].

**Spectroscopy.** Low dispersion spectra (resolution 2 Å pixel$^{-1}$) of Nova Per 1992 (GRO J0422+32) were obtained in the high ($V \leq 14$ mag) and low ($V \geq 18$ mag) optical states. In the high state the object had a blue continuum, showed blue variations on time-scales of hours to days and weak variable emissions of H$\alpha$, H$\beta$, He II 4686 and 5411, N III 4640. In the low optical state the spectra showed some emission features (H$\alpha$, H$\beta$ and probably He I 5876) on a red continuum.

**Photometry.** In the high optical state the luminosity of Nova Per 1992 was irregularly variable in different colour bands on time-scales of 4 ms to 200 s with relative amplitudes of 0.5...4. The shortest flares had rise times of 4...40 ms (Fig. 1) which allows us to establish an upper limit of $10^8 \ldots 10^9$ cm on the size of the region producing the flares. The brightness temperatures for these events exceed $10^8 \ldots 10^9$ K. The power spectrum of the detected variability is flat from 0.01 to 250 Hz. In the low optical state Nova Per did not show any significant variability on times up to hours.



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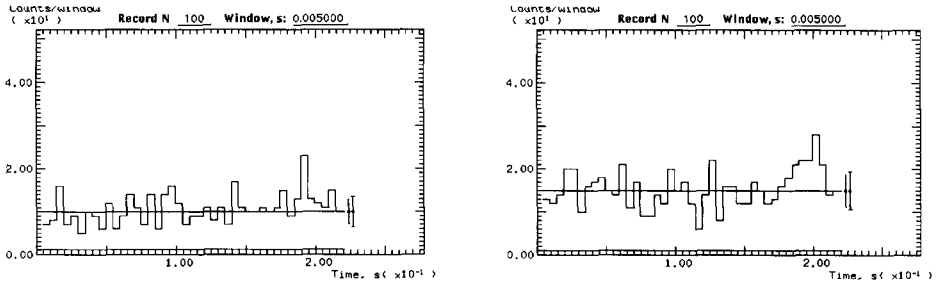


*Figure 1.* Flash of Nova Per 1992 in $V$ (left) and $B$ (right) bands, 1993 January 18.

## 2. Some conclusions

(i) We believe that the detected optical variability of GRO J0422+32 (in the high state) could be the result of a fragmentation in the accreting structure, where sizes of the plasma 'blobs', $l$, correspond to rise times of the flares, $\tau$ where $l \leq c\tau$.
(ii) All the detected shortest time-scale events have, with high probability, a nonthermal origin since, for brightness temperatures in the optical range exceeding $10^8 \ldots 10^9$ K, it is very difficult to propose a thermal mechanism for the production of the photons.
(iii) The differences between power spectra of the X–ray and optical variabilities suggest that the flares could be generated at equal distances from a compact object but by different mechanisms [4, 6].

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## References

1. Bartolini, C., Guarnieri, A., Piccioni, A., et al., 1994, Ap. J. Supp., **92**, 455
2. Beskin, G., Kajsin, S., Neizvestny, S., et al., 1993, IAUC, 5863
3. Beskin, G.M., Neizvestny, S.I., Pimonov, A.A., 1982, in Proc. IAU Colloq. 67, "Instrumentation for Astronomy with Large Optical Telescopes", ed. C.M. Humphries (Dordrecht: Reidel), p181
4. Ikhsanov, N.R., Pustil'nik, L.A., 1994, Ap. J. Supp., **90**, 959
5. Piccioni, A., Bartolini, C., Guarnieri, A., Giovanelli, F., 1979, Acta Astron., **29**, 463
6. Pustil'nik, L.A., Shvartsman, V.F. 1974, in Proc. IAU Symp. 64, "Gravitational Radiation and Gravitational Collapse", ed. C. Dewitt-Morette (Dordrecht), p213