## The Luminous Supersoft Source, SSS<sub>1</sub>, in NGC 300

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## Abstract

The nearby galaxy NGC 300 is hosting two luminous transient supersoft sources with bolometric luminosities above  $3x10^{38}$  ergs/s (assuming black-body spectra with kT~60-70 eV). For one of these, SSS<sub>1</sub>, a periodic modulation of 5.4h was observed in a XMM-Newton observation from January 2001, but not 6 days earlier when the luminosity was much higher. We report here the detection of a new outburst from this source occurring during two long XMM-Newton observations from December 2016. The luminosity was similar as in December 2000, and the 0.2-2.0 keV light curve revealed again a periodic modulation, with a period of 4.68+-0.26 h, significant only in the first part of the observation. Taking into accounts the large uncertainties (the 2001 period re-estimated at 5.7+-1.1 h), the two values could be marginally compatible, and maybe associated with an orbital period. Thanks to these long exposures, an additional absorption feature is now visible in the spectra, that we modelled with an absorption edge. This component decreases the bolometric luminosity below  $3x10^{38}$  ergs/s and would therefore allow the presence of a white dwarf with a mass close to the Chandrasekhar limit. The system was found in outburst in 1992, 2000, 2008, and 2016 suggesting a possible recurrence period of about 8 years.



XMM-Newton images of SSS<sub>1</sub> in the 0.2-2.0 keV band, taken at four different epochs.



XMM-Newton light curve of SSS<sub>1</sub> from Dec. 2016, in the 0.2-2.0 keV band. The red curve shows the corresponding background rate.



Absorbed fluxes (blue dots) and upper limits (red triangles), in the 0.2-2.0 keV band, from the ROSAT, XMM-Newton and Chandra observations.



Lomb-Scargle periodogram on the first half of the light curve, binned at 100s. The best period is 4.68 h +- 0.26 h.



HST ACS/WFC optical image around the Chandra position of SSS<sub>1</sub> (green circle with 1" radius). Sources indicated by cyan circles are between 25 and 27 mag.



Light curve of  $SSS_{1}$ , from the first half, folded at the best period of 4.68 h, with best fit sine function overlaid.



Detrended light curve of SSS<sub>1</sub> (black), with extrapolated sine function (red) and long-term trend (blue) overlaid.



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Simultaneous spectral fit of SSS<sub>1</sub> from both observations from Dec. 2016, using an absorbed black-body model (tbabs\*bbody), and the corresponding residuals.

## **Paper in preparation!**

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