Title:	The super-soft source phase of the recurrent nova V3890 Sgr
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Abstract:	Context. The 30-yr recurrent symbiotic nova V3890 Sgr exploded on 2019 August 28 and was observed with multiple X-ray telescopes. Swift and AstroSat monitoring revealed slowly declining hard X-ray emission from shocks between the nova ejecta and the stellar wind of the companion. Later, highly variable super-soft-source (SSS) emission was seen. An XMM-Newton observation during the SSS phase captured the high degree of X-ray variability in terms of a deep dip in the middle of the observation. Aims. This observation adds to the growing sample of diverse SSS spectra and allows spectral comparison of low- and high-state emission to identify the origin of variations and subsequent effects of such dips, all leading to new insights into how the nova ejecta evolve. Methods. Based on an initial visual inspection, quantitative modelling approaches were conceptualised to test hypotheses of interpretation. The light curve was analysed with a power spectrum analysis before and after the dip and with an eclipse model to test the hypothesis of occulting clumps as in U Sco. A phenomenological spectral model (SPEX) was used to fit the complex Reflection Grating Spectrometer (RGS) spectrum accounting for all known atomic physics. A blackbody source function was assumed, as in all atmosphere radiation transport models, while the complex radiation transport processes were not modelled. Instead, one or multiple absorbing layers were used to model the absorption lines and edges, taking into account all state-of-the-art knowledge of atomic physics. Results. In addition to the central deep dip, there is an initial rise of similar depth and shape, and, after the deep dip, there are smaller dips of ~10% amplitude, which might be periodic over 18.1-min. Our eclipse model of the dips yields clump sizes and orbital radii of 0.5–8 and 5–150 white dwarf radii, respectively. The simultaneous XMM-Newton UV light curve shows no significant variations beyond slow fading. The RGS spectrum contains both residual shock emission at short wavelengths and the SSS emission at longer wavelengths. The shock temperature has clearly decreased compared to an earlier Chandra observation (day 6). The dip spectrum is dominated by emission lines as in U Sco. The intensity of underlying blackbody-like emission is much lower with the blackbody normalisation yielding a similar radius to that of the brighter phases, while the lower bolometric luminosity is ascribed to lower Teff. This would be inconsistent with clump occultations unless Compton scattering of the continuum emission reduces the photon energies to mimic a lower effective temperature. However, systematic uncertainties are high. The absorption lines in the bright SSS spectrum are blueshifted by 870 ± 10 km s−1 before the dip and are slightly faster, 900 ± 10 km s−1, after the dip. The reproduction of the observed spectrum is astonishing, especially that only a single absorbing layer is necessary while three such layers are needed to reproduce the RGS spectrum of V2491 Cyg. The ejecta of V3890 Sgr are thus more homogeneous than many other SSS spectra indicate. Abundance determination is in principle possible but highly uncertain. Generally, solar abundances are found, except for N and possibly O, which are higher by an order of magnitude. Conclusions. High-amplitude variability of SSS emission can be explained in several ways without having to give up the concept of constant bolometric luminosity. Variations in the photospheric radius can expose deeper lying plasma that could pulse with 18.1 min and that would yield a higher outflow velocity. Also, clump occultations are consistent with the observations.

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