**SUMMARY**

ASTROSAT is a multi-wavelength observatory with 4 main instruments: UVIT, an ultraviolet and visible wavelength telescope; SXT, a soft X-ray imaging telescope; LAXPC, a broad-band large-area X-ray timing instrument; and CZT, a hard X-ray coded-mask imaging telescope. These four instruments operate simultaneously and are co-pointed, yielding a very wide band view of X-ray and UV emitting systems.

ASTROSAT carried out an observing campaign on the X-ray binary Hercules X-1 during 2016-2018. Here we report on the results of these observations, including FUV observations of Her X-1 with UVIT.

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**ASTROSAT MULTIWAVELENGTH OBSERVATIONS OF THE X-RAY BINARY HERCULES X-1**

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**Sources of X-ray emission in Her X-1**

1. Direct X-ray beams (pencil and/or fan beam) originating in the accretion column of the accreting pulsar (Her X-1; Leahy 2004).
2. Weak isotropic emission high above the accretion column resulting from Thomson scattering of the direct X-rays (Scott et al. 2000).
3. Soft emission below 1 keV, modelled by a black-body of temperature $T > 0.1$ keV, resulting from reprocessing of the hard X-rays in the outer neutron star magnetosphere and/or the inner edge of the accretion disc (McCray et al. 1982).
4. Reflection of the X-ray emission by the illuminated inner edge of the disc (Leahy 2002), and the irradiated face of the companion star (Leahy 1999).
5. Very weak (at 1% of the direct flux) unpolarised scattered emission by an extended accretion disc corona which is present throughout the 35-day cycle (Leahy 2015).

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**ASTROSAT Observations of Her X-1**

The 2016 observation was carried out in AG2 during MJD57827.6 to MJD57829.0 and the 2017 observation in AG3 during MJD57933.5 to MJD57934.3, the 2018 observation. The orbital phase was found using the ephemeris of Leahy, 2002 but are better constrained. The 35-day phase was found using the SWIFT/BAT light-curve of Her X-1. The 2016 observation was during late low state and turn on to Main High (see AG2 below), the 2017 observations during early Main High state (see AG3 below), and the 2018 observation......

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**Rationale for the SHAPE model**

The heated disk emission is the cyan dashed line, the heated part of HZ Her is shown in pink, the heated region in the outer neutron star magnetosphere and/or the inner edge of the accretion disc. The observer’s view is tilted accretion lobe. The shadow caused by the accretion disk on the heated part of HZ Her and the reflection disc blockages of HZ Her are shown in black. The heated regions in the outer neutron star magnetosphere and/or the inner edge of the accretion disc from the surface of the accretion disk (Leahy & Chen, in prep). The FUV light curve is sensitive to the shape of the disk shadow and provides new strong constraints on shape of the tilted and heated disk.

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