Reflection spectra in accreting neutron stars

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Purpose of the STSM

The purpose of the STSM was to analyse the spectra of the neutron-star (NS) low-mass X-ray binary (LMXB) the Rapid Burster (4U 1730–335, hereafter RB) obtained during our ToO observations on October 6, 2015. Our goal for this ToO was to catch this transient source in a bright hard state during one of its frequent outbursts, to study its reflection spectrum and how it varies during the accretion instabilities known as type II bursts that make the RB unique among NS LMXBs.

The host, Dr. Nathalie Degenaar, is a member of the Cambridge X-Ray Group at the Institute of Astronomy of the University of Cambridge, which is led by Prof. Andrew Fabian, one of the world's leading experts in the study of X-ray reflection in accretion discs.

Work carried out during the STSM

Our data consisted of roughly 40 ks of observations containing several tens of accretion bursts. We split the dataset between burst and non-burst intervals.

Data reduction of the *XMM-Newton* dataset proved non-trivial. Firstly, the calibration of the instrument (the EPIC-pn camera in timing mode was used, to minimize pile-up) needed to be carefully investigated. Secondly, due to the very high count rates reached by the RB during the burst intervals, and the resulting pile-up, particular care was necessary in the extraction of the spectra during these times. We acknowledge the *XMM-Newton* Helpdesk for extensive collaboration in the investigation of the issues that arose in this phase. A talk to the Cambridge X-ray Group mid-way during my visit also provided insightful comments from members who are expert in the study of reflection spectra and *XMM-Newton* data reduction.

Main results

The first draft of our upcoming publication was completed. Fitting the reflection spectrum with Dr. Lohfink's models will allow us to obtain a measurement of the inner-disc radius.

Particularly, we will soon be able to prove whether the best fits to burst and non-burst spectra indicate different inner-disc radii. Measuring such variations would be of fundamental importance to understand magnetospherically induced accretion instabilities.

Future collaboration and foreseen publications

Collaboration is ongoing and we are currently working on a paper. Support from the COST Action MP1304 will be acknowledged.