HRC Update

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The High Resolution Camera (HRC) remains healthy and busy as ever, enabling legacy-class *Chandra* science with many high-impact results over the past year. One of these highlights is found in the shining poles of Jupiter, focus of a recent HRC observation designed to capitalize on a time when the planet's tilt relative to Earth provided excellent simultaneous views of both its northern and southern X-ray-bright aurorae. HRC's large field of view encompassed the entire planet as it rotated, and its exquisite spatial and temporal resolution revealed not only the morphology of X-ray emission at both poles, but also how the aurorae pulsed and shimmered in time.

In a paper recently published in *Nature Astronomy*, Dunn et al. compare the pulsations of the northern and southern auroral X-ray hot-spots. The team found that the periodicity and brightness of the northern and southern Jovian aurorae were largely uncorrelated, such that they pulsed almost completely independently from one another. This surprising result is highly unlike Earth, whose northern and southern aurorae mirror one another almost exactly. The implication, then, is that an asymmetric magnetospheric process may be at play on the Jovian day side, in tension with current models for the generation of these X-ray aurorae. *Chandra*/HRC and *XMM-Newton* will continue to monitor Jupiter's brilliant polar light shows over the next few years. In a powerful demonstration of the HRC's multiwavelength synergy, some of these observations will be coordinated with in-situ measurements during perijove passages of the Juno spacecraft, currently in polar orbit around the mighty planet.

While HRC instrument performance remains excellent and stable overall, it has long been known that the detector gain has been steadily declining since the beginning of the mission. This gain sag can slowly decrease quantum efficiency (QE) and increase spatial variations within the detector. As discussed in last year's newsletter, this issue is both understood and expected. Nevertheless, in an attempt to mitigate this sensitivity loss, the operating voltage of both HRC-S microchannel plates was increased in March of 2012, nearly restoring the instrument's sensitivity to what it had been at launch. The gain resumed dropping immediately following the voltage change, however, this time with a steeper decay rate. The gain sag has therefore "caught up", and is now roughly where it was just prior to the intervention in 2012. The instrument PI, Ralph Kraft, has commissioned an HRC Gain Working Group which, alongside the *CXC* Calibration group, is charged with better understanding and mitigating this loss of sensitivity for the HRC-S. In pursuit of the latter goal, the Calibration team may soon recommend that another voltage increase be implemented in the coming year.

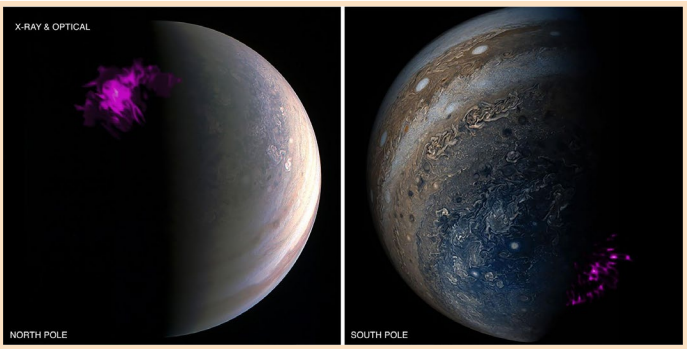

Figure 1: A *Chandra*/HRC and Juno composite of Jupiter and its stunning X-ray aurorae, shown here in purple. Credit: X-ray: NASA/*CXC*/UCL/W.Dunn et al., Optical: South Pole: NASA/JPL-Caltech/SwRI/MSSS/Gerald Eichstädt/Seán Doran; North Pole: NASA/JPL-Caltech/SwRI/MSSS. Science paper: Dunn, W.R. et al., 2017, *Nature Astronomy*, 1, 758.

Meanwhile, the HRC IPI and Calibration teams continue their work in optimizing the performance of the instrument. Recent progress has been made with regard to improving the background rejection algorithm, wherein background/non-X-ray events are vetoed based upon certain features of the electron cascade they create within the HRC's microchannel plates. While the *current algorithm* is excellent, it was developed at the beginning of the mission, so the team is now testing whether it can be made more effective with (slight) modifications. The HRC team will keep the community apprised of its progress as this project moves forward.

Finally, the HRC team is delighted to announce that it has grown with the recent hiring of Grant Tremblay and Esra Bulbul. Almus Kenter has recently taken up a Professorship in Maine, but remains part of the instrument team to support laboratory work and flight operations. ■