
Recent Updates to *Chandra* Calibration

Larry David

There were seven updates to the *Chandra* calibration database (CALDB) during 2011. These releases contained the standard quarterly calibration of the ACIS-S and ACIS-I gains and the yearly calibration of the HRC-I and HRC-S gains. While the QE of the HRC-I has been very steady, the QE of the HRC-S along the dispersion direction of LETG spectra has declined by about 5% during the *Chandra* mission. The QE at the location of the zeroth order in LETG spectra has declined by about 8%. The HRC-S QE decline has been accounted for by producing a separate QE map for each year since launch. The new HRC-S QE maps apply a grey correction, i.e., wavelength independent, to all HRC-S data. Yearly LETG/HRC-S observations of the white dwarf HZ43 show that the QE loss is essentially grey up to about 2009. More recent observations show that the HRC-S QE loss is more significant at longer wavelengths. This is discussed in more detail in the LETG article on page 13.

During the past year, there were also updates to the HEG and MEG first order transmission efficiencies and the LEG higher order transmission efficiencies ($m=2-10$). The LEG updates were derived from a deep observation of the Crab nebula. With the latest LEG transmission efficiencies, the higher order fluxes are consistent with the first order flux to within 5–10%. By examining HETG/ACIS-S observations of a sample of about 30 AGN, we have derived corrections for the first order transmission efficiencies of both the HEG and MEG. Using those updated first order transmission efficiencies, the derived first order HEG and MEG fluxes are consistent to within about 5%.

The CXC calibration team has engaged in a number of internal cross-calibration studies over the past year. The supernova remnant G21.5-09 has been observed periodically by all four focal plane detectors over the course of the *Chandra* mission. Using the latest CALDB, the derived G21.5-09 fluxes for on-axis observations with the four focal plane detectors are consistent to within about 3%.

The *Chandra* calibration team continues to support the efforts of the International Astronomical Consortium for High Energy Calibration (IACHEC). Several CXC calibration scientists attended the 4th annual IACHEC meeting in Villa Grazioli, Italy between April 11–14, 2011. These meetings bring together calibration scientists from all present and most future X-ray and γ -ray missions. Collabora-

tions among the calibration scientists have produced several papers that discuss the current cross-calibration status of the present fleet of X-ray telescopes. All of these papers have been published in *Astronomy & Astrophysics* and they contain a great deal of useful information for observers.