X-raying the Ultraluminous Infrared Starburst Galaxy and Broad Absorption Line QSO, Markarian 231

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Abstract

As a well-studied ultraluminous infrared galaxy, Markarian 231 is perhaps the prototypical starburst/QSO composite galaxy where both phenomena contribute significantly to the high bolometric luminosity. X-ray studies of ultraluminous infrared galaxies provide essential information about the end-products of stellar evolution as well as the immediate environment of an active nucleus. As an X-ray target, Mrk 231 is of additional interest as a Broad Absorption Line (BAL) QSO; members of this class are notoriously weak X-ray sources with few X-ray spectra in the literature. With 40 ks of *Chandra* ACIS-S exposure, new information on both the starburst and QSO components of the X-ray emission has been obtained. Most notably, significant nuclear variability at energies above 2 keV indicates that *Chandra* has probed within light hours of the central black hole. The bulk of the X-ray luminosity is emitted from an unresolved nuclear point source, and the spectrum is remarkably hard with the majority of the flux emitted above 2 keV. The best-fitting model indicates that the spectrum contains a strong reflection component as well as a scattered power-law continuum absorbed at low energies. In addition, soft, thermal emission from the galaxy disk encompasses the optical extent of the galaxy and exhibits resolved structure. An off-nuclear point source with 0.35–8.0 keV luminosity, $L_{\rm X} = 5 \times 10^{39}$ erg s^{-1}, consistent with the ultraluminous X-ray sources in other nearby starbursts, is also detected.

CATEGORY: ACTIVE GALAXIES AND QUASARS