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Obscuration and Orientation Effects in Chandra-Observed, Medium Redshift 3CRR Sources

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Low-frequency radio selection finds active galactic nuclei regardless of the amount of obscuration. A complete, 178 MHz-selected (and so obscuration-unbiased) sample of medium redshift ($0.5 < z < 1$) 3CRR sources now has Chandra X-ray observations. The sample includes quasars and narrow-line radio galaxies (NLRGs) matched in radio luminosities, and the radio core fraction provides an estimate of orientation. The quasars are X-ray bright and soft and are viewed face-on. The NLRGs are mainly X-ray faint, harder, and viewed edge-on. These results confirm orientation-dependent obscuration as in Unification models, but an additional parameter, a range of L/L_{Edd} ratios, is needed to explain the large range of column densities observed for NLRGs with intermediate viewing angles. The overall fraction of Compton-thick sources is 22%, similar to that found by Wilkes et al. (2013) for the $1 < z < 2$ 3CRR sample. However, the medium-z sample has a higher fraction of NLRGs that are Compton-thin (45% vs. 29%), implying a larger covering factor of obscuring, Compton-thin material at intermediate viewing angles or a "puffed-up" torus atmosphere. We interpret this as being due to the broader range of L/L_{Edd} ratios (extending to lower values) in the medium-z sample. In the high-z sample, the narrow range (and high values) of L/L_{Edd} allowed orientation to dominate the observed X-ray properties of the sample. A few sources have inconsistent optical and X-ray Type1/Type2 classifications. These have intermediate viewing angles, where L/L_{Edd} determines the nature of the obscurer: accretion disk wind (high L/L_{Edd}) or atmosphere of the dusty torus (low L/L_{Edd}) and thus the optical vs. X-ray type.