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A Chandra and ALMA Study of X-ray-irradiated Gas in the Central ~100 pc of the Circinus Galaxy

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The AGN effect on host galaxies is an interesting topic that has been often discussed so far. The AGN is usually X-ray luminous, and thus X-ray irradiation by the AGN is unavoidable for its host galaxy. We report our recent study on X-ray-irradiated gas in the central ~100 pc of the Circinus galaxy (TK+19), a Compton-thick AGN host, at 10-pc resolution using Chandra and ALMA. Based on ~200 ksec Chandra/ACIS-S data, we created an image of the Fe Kalpha line at 6.4 keV, tracing X-ray-irradiated dense gas. The ALMA data in Bands 6 (~270 GHz) and 7 (~350 GHz) cover five molecular lines: CO(3−2), HCN(3−2), HCN(4−3), HCO^+(3−2), and HCO^+(4−3). The detailed spatial distribution of dense molecular gas was revealed, and compared to the iron line image. The molecular gas emission appeared faint in regions with bright iron emission. Motivated by this, we quantitatively discuss the possibility that the molecular gas is efficiently dissociated by AGN X-ray irradiation (i.e., creating an X-ray-dominated region). Based on a non-local thermodynamic equilibrium model, we constrained the molecular gas densities and determined that they are as low as interpreted by X-ray dissociation. Furthermore, judging from inactive star formation (SF) reported in the literature, we suggest that the X-ray emission has potential to suppress SF, particularly in the proximity of the AGN.

Topic

Active Galactic Nuclei: accretion physics and evolution across cosmic time

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