The power source in dusty galaxies – a Chandra view of DOGs and an astrochemical study of dust in nearby galaxies

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Abstract

The mid-through-far IR emission in dusty galaxies arises from star formation, activity from a galactic nucleus (associated with the growth of an underlying supermassive black holes), or a combination of both. We recently exploited the combined use of Herschel and the Chandra COSMOS Legacy Survey to probe for active galactic nuclei (AGN) in > 100 Dust-Obscured Galaxies (DOGs). Although 20% present significant AGN activity, X-ray stacking points to a mix between AGN and star formation. DOGs typically lie on the main sequence of star-forming galaxies or below, suggesting they are still building up of the stellar bulk or have started quenching. We find 30% Compton-thick AGN candidates, consistent with the frequency found within other soft- and hard-X-ray selected AGN populations. This suggests that the large column densities responsible for the obscuration in Compton-thick AGNs must be nuclear and have little to do with the dust obscuration of the host galaxy. How can we strive to detect such deeply-embedded AGNs? We have been investigating the imprint that different power sources may have on the host's mid-IR emission using the GOALS and ATLAS samples. We look at the PAH population in terms of size and charge using the NASA Ames PAH Database, a large spectroscopic library of PAH molecules. We find that the PAH population in IR-luminous galaxies is dominated by small and neutral molecules, with variations in the proportion of charged and neutral PAHs for galaxies with stronger AGNs. Our results show that AGN alter the ISM astrochemistry without destroying PAHs. This is in agreement with laboratory works pointing to the stability of PAH molecules and motivates further use of PAHs to probe for the radiation field in these dusty, extreme environments.

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