

The great observatories: synergie between Spitzer, Chandra and Newton

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Strong evidence is now emerging for a close link between intense starburst activity and the growth of supermassive black holes during the hierarchical build up of galaxies. For example, it is now known that the histories of cosmic star formation and luminous active galactic nucleus activity track each other rather well, both showing a dramatic decline between $z=2$ and today. The discovery of massive dark objects, remnants of once-luminous quasars in the bulges of many nearby galaxies, further demonstrates that the creation and fuelling of quasars is inextricably linked to the formation of galaxies. The proportionality between present day black hole mass and the mass of their host galaxy spheroids is most easily explained if the formation of the two components was coeval, i.e. if the black hole was built up by accretion of the same gas that rapidly formed the stars of the spheroid. However, the picture is more complex observationally: AGN with redshifts and luminosities in the interval responsible for the majority of the integrated accretion luminosity density lie, for the most part, in quiescent, finished host galaxies. Only a small fraction of the distant, luminous AGN population, around 15%, appear to lie within the dusty, luminous starburst galaxies expected.

The emission from AGN is most conspicuous in the X-ray band. AGN emit about 10% of their bolometric power in the X-ray, and the vast majority of sources detected in X-ray surveys turn out to be AGN. Furthermore, as X-rays are very penetrating, they allow us to find quasars even when they are quite heavily obscured by gas and dust. On the other hand, stars emit little of their energy in the X-ray, but the most vigorous starburst galaxies are often so dusty that only a tiny fraction of their ultraviolet radiation manages to escape, and almost all their power is reprocessed by dust and re-emitted in the infrared. Thus X-ray and infrared observations are the ideal combination for studying the role of AGN in galaxy formation. I will describe some of the recent results from Spitzer, Chandra and XMM-Newton which suggest an evolutionary sequence in the development of spheroid and black hole in distant quasars and ultraluminous infrared galaxies. In some cases, we also observe star formation in the immediate proto-cluster environment of the quasar, which suggests that a full cluster-complement of massive galaxies may form simultaneously in overdense regions.