The Energy Sources of Ultraluminous Galaxies

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The ultraluminous galaxy IRAS 19297-0406 as seen by the Hubble Space Telescope. An infrared study finds that in about one-third of such galaxies there is a supermassive black hole in the nucleus dominating the energy production. Credit: NASA, the NICMOS Group (STScI, ESA), and the NICMOS Science Team (University of Arizona)

(PhysOrg.com) -- Ultraluminous infrared galaxies ((ULIRGs) are galaxies whose luminosity exceeds that of a trillion suns; for comparison, the Milky Way galaxy has a typical (and much more modest) luminosity of only about ten billion suns. ULIRGs were discovered by an all-sky infrared survey satellite in the 1980's, and since then the origin(s) of their huge infrared emission has been widely debated. Extreme infrared activity is known to be associated with interacting galaxies, and optical imaging indeed shows that many ULIRGs are in collision, but this fact does not answer the question of what physical mechanism powers the luminosity. Might the same process be underway at a low level in our galaxy?

The two primary known sources of global energy production in galaxies are star formation and accretion activity around a massive black hole in the nucleus (a so-called active galactic nucleus). Both of them produce radiation that heats up the dust -- the origin of the intense infrared emission.

The dust obscures optical light and makes conventional diagnostics difficult, but the dust emission itself has specific color characteristics that can distinguish between the two cases. SAO astronomer Guido Risaliti and seven of his colleagues have used the Spitzer Space Telescope to study the infrared emission from seventy-one ULIRGs in an attempt to quantify the relative role each process plays in the energetics of ULIRGs.

The scientists find that approximately 70% of the sources have the characteristic signature of an active nucleus, a significant conclusion made possible by the use of their dust emission diagnostic technique. Furthermore, they find that, with regard to energy production, star formation predominates in approximately two-thirds of the sources; in the other one-third of ULIRGs the nucleus plays the dominant role in powering the galaxy, and this fraction increases among the most luminous ULIRGs.

Our Milky Way does have a massive black hole at its nucleus, but now activity around it is very quiescent. Perhaps when the Milky Way collides with the Andromeda galaxy in a few billion years, an event many astronomers suspect will occur, the interaction will trigger the nucleus to become more active, and our galaxy to become, if not ultraluminous, then at least more luminous than it is today.

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