A wealth of molecules in an extreme galaxy

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A Hubble image of the galaxy Arp 220, the brightest object in our local universe. A team using the Submillimeter Array studied the gas component of this galaxy, and concluded that bursts of star formation power its dramatic energetics. Credit: NASA and Hubble

(PhysOrg.com) -- Arp 220 is the closest galaxy to the Milly Way with an extreme luminosity, defined as being more than about 300 times that of our own galaxy. Some dramatic galaxies have values of luminosity ten times brighter still. Astronomers are still piecing together the reasons for these huge energy outputs, while sorting out why our own galaxy is so modest.

The two primary suspects for the energetics are bursts of star formation that produce many hot young stars, and processes associated with accretion of material onto a supermassive black hole at a galaxy's nucleus. Arp 220 is the closest example, and one of the best places to

probe these scenarios.

A team of astronomers including SAO astronomer Jun-Hui Zhao have used the Submillimeter Array (SMA) to obtain the first unbiased galaxy survey of molecular and atomic lines using a telescope array. They covered a complete, large wavelength interval in the millimeter regime that is accessible through Earth's atmosphere. The team reports finding seventy-three spectral features from fifteen molecular species in this survey band. A remarkable 28% of the total flux from this galaxy in this band is emitted by these molecules. The SMA also obtains images of the galaxy at each of the many wavelengths.

The results are consistent with Arp 220's luminosity being driven primarily by star-formation. The chemistry of the galaxy derived from the observations also leads to this conclusion, with species normally enhanced by star formation clearly detected. Moreover, it appears one such burst of activity is currently underway. The team estimates, for this extreme galaxy, that several million regions of activity are localized within a relatively small volume (a few thousand light-years) around the nucleus. The new results are an important improvement in our understanding of what powers extreme galaxies, and how they differ from the Milky Way.

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