Sequential Starburst in Arp220?

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The triggering and evolution of starbursts is not yet well understood. However, the most likely triggers for starbursts are galaxy interactions/mergers, gravitational instabilities, or density waves. The starburst may then propagate through the galaxy and possibly transform it into an Ultraluminous Infrared Galaxy (ULIRG). To examine a starburst galaxy in action, we are carrying out an extensive campaign to observe Arp 220, the closest representative of the ULIRG class.

Arp 220 is the archetypical ULIRG. Its luminosity, $L_{8-1000\mu\mathrm{m}} = 1.4 \times 10^{12}$ L_{sun}, is mostly emitted as far-infrared continuum emission from dust. Arp 220 is the product of a galaxy merger with an apparent double nucleus (separation$\approx 1'' = 370$ pc). The central few kpc contain large amounts of molecular gas; the mass of the nuclear region is estimated to be $\sim 10^{10}$ M_{sun} (Scoville et al. 1997; Downes & Solomon 1998). Previous CO observations with millimetre interferometers revealed a rotating disk of $\sim$100 pc radius around each of the nuclei (Sakamoto et al. 1999; Mundell et al. 2001). Single-dish CO spectra of the disk are double-peaked. However, single dish CN 2-1 (Aalto et al. 2002) and HCN 4-3 (Wiedner et al. 2002) observations show only a single peak. This discovery suggests that the physical and/or chemical properties of the two nuclei differ. They may represent different stages of a propagating starburst.

To further investigate the properties of the two nuclei, we have created several sub-arcsecond interferometric maps with data from the Submillimeter Array (SMA). The observations included the CO 3-2, 6-5, CN 2-1, HCN 4-3 lines and the $\sim$1200, 850 and 430μm continuum. Both nuclei are point-like sources in the continuum emission and the lower CO transitions. However, our preliminary analysis of the HCN data shows that most of the emission stems from the western nucleus. At the meeting we will present a subset of our SMA observations, with emphasis on the HCN 4-3 data. The physical and chemical properties of the nuclei are estimated, and the likelihood that Arp 220 is undergoing sequential starburst is discussed.

References:

Aalto, S., Polatidis, A. G., Hüttenmeister, S., & Curran, S. J. 2002, A&A, 381, 783
Downes , D., & Solomon, P. M. 1998, ApJ, 507, 615
Mundell, C. G., Ferruit, P., & Pedler, A. 2001, ApJ, 560, 168
Sakamoto, K., Scoville, M. Z., Yun, M. S., Crosas, M., Genyel, R., & Tacconi, L. J.1999, ApJ, 514, 68
Scoville, N. Z., Yun, M. S., & Bryant, P. M. 1997, ApJ, 484, 702
Wiedner, M. C., Wilson, C. D., Harrison, A., Hills, R. E., Lay, O. P., & Carlstrom , J. E.. 2002, ApJ, 581, 229