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IRAS 17208: An Advanced Merger with a Gas-Rich Starburst Evolving towards an Elliptical Galaxy?

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Abstract. The study of ultraluminous infrared galaxies (ULIRGs) in different evolutionary phases is central to probing the ULIRG-QSO connection and the formation of elliptical systems from the mergers of gas-rich spirals. Of particular interest is IRAS 17208-0014, a ULIRG which has a very high infrared luminosity ($> 2 \times 10^{12}$ L$_\odot$) and appears to be in an interesting merger phase. We present observational evidence which suggests that IRAS 17208 is an advanced merger which hosts a gas-rich starburst, bright stellar clusters reminiscent of nearby super star clusters, and may be evolving towards an elliptical-like system.

1. Summary of Results

HST WFPC2 *I*-band (Fig. 1) and ground-based *R*-band image of IRAS 17208 show two prominent tidal tails extending out to ~ 20 kpc, suggesting that the ULIRG is a merger of two high angular momentum systems such as two disk galaxies. The profile of a *K*-band image is well fitted by a de Vaucouleurs $r^{1/4}$ profile out to a radius of $12''$ or 10 kpc. This suggests that violent relaxation has already set in and the merger is at a relatively advanced phase. NICMOS *J*, *H*, *K* imaging (Scoville et al. 2000) shows only one nucleus at the resolution of $0.075''$ (60 pc), suggesting that the nuclei of the two progenitors have already merged or/and one of the progenitors was a late-type spiral with a faint nucleus.

High ($1.1 \times 0.7''$ or 880×560 pc) resolution OVRO CO (2–1) observations reveal a large amount ($> 4.5 \times 10^{10}$ M$_\odot$) of cold molecular gas which is mostly concentrated in the inner $1''$ (800 pc) radius (Fig. 1) and shows predominantly circular motions. In this region, the NICMOS images (Scoville et al. 2000) reveal interesting nuclear structure including a number of very bright star clusters. The molecular gas appears to be fueling an intense starburst forming stars at a rate of 350–430 M$_\odot$ yr^{-1} based on IR and radio continuum tracers. Optical line ratios suggest properties between HII region and LINER type nuclei. Faint streams

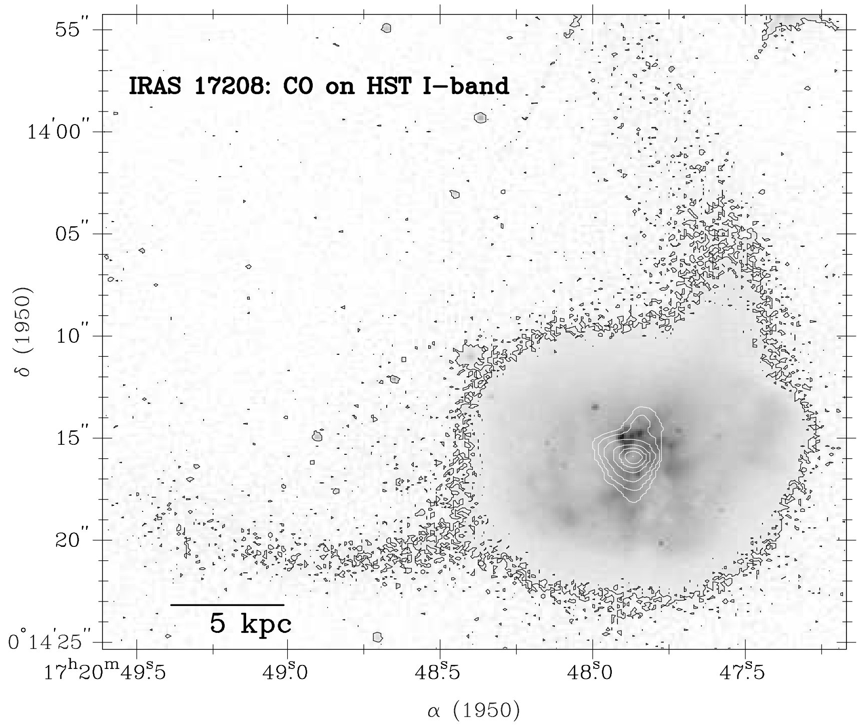

Figure 1. $1.1 \times 0.7''$ (880×560 pc) resolution OVRO CO (2–1) observations (white contours) overlaid on the *HST* *I*-band image.

of molecular gas extend northeast and south out to 1.5 kpc and non-circular motions are present to the south where a high extinction 'tail' in NICMOS color maps extends to $1.6''$ (1.5 kpc).

The bright stellar clusters or associations of clusters in the NICMOS images appear to be forming in merging events. They could be analogs of super star clusters which are found in nearby starbursts and are postulated to be proto-globular systems. Using stellar population synthesis codes, we estimate the ages, masses, and extinction of the stellar clusters. The clusters in the region of strong CO emission have the reddest $I-H$ colors and tend to lie along reddening vectors in the $I-H$ versus $H-K$ plane. Ages of 10 Myr to a few tens of Myr and masses of several $(10^6 - 10^7)$ $M_\odot$ are typical of many clusters. Hot dust emission appears to be required in order to account for the NIR colors of several clusters, but degeneracy between reddening due to hot dust and reddening due to extinction is difficult to break in a color-color analysis from data with a small dynamic range in colors.

References

Scoville et al. 2000, AJ, 119, 991