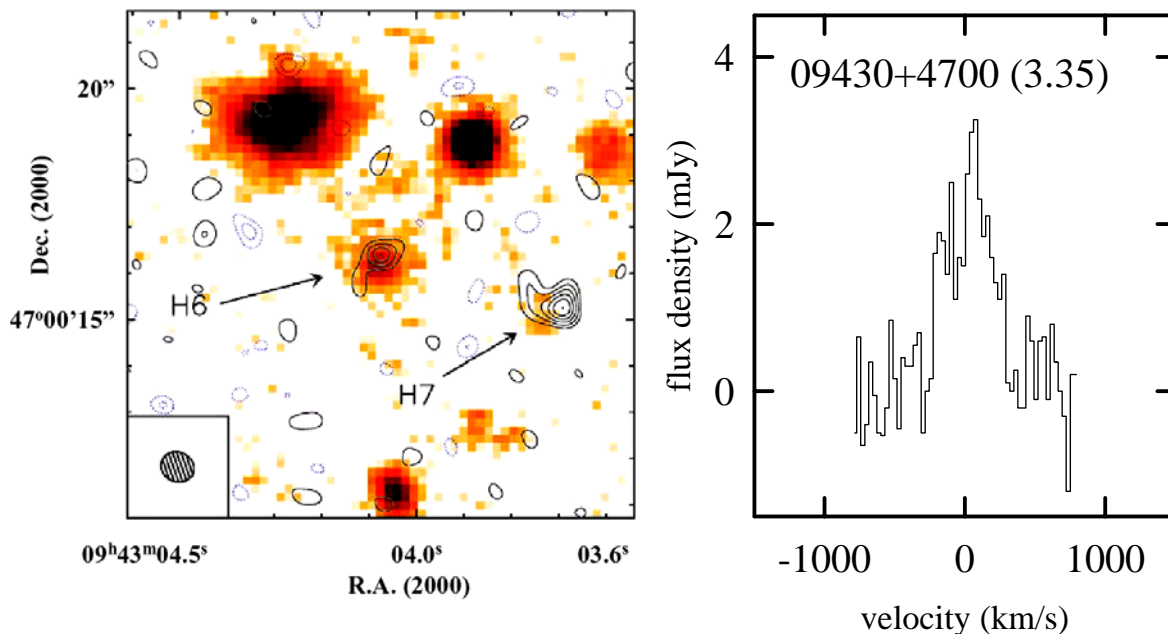


Together with researchers from the IRAM community, the US and the UK we have obtained  $\sim 0.6''$  resolution, IRAM interferometry of the 1.3mm continuum and line emission of four submillimeter galaxies at redshifts between 2.3 and 3.4. The CO 3-2 or 4-3 line profiles in at least two of the sources are double-peaked, indicative of ordered orbital motion in a rotating disk or galactic merger. The FWHM intrinsic source sizes of all four sources are less than  $0.5''$ . Including the previously resolved SMMJ02399-0136 (Genzel et al. 2003) the median FWHM corresponds to about 3 kpc. The compactness of the sources excludes that the far-infrared/submillimeter emission comes from a cold ( $T < 30\text{K}$ ), extended dust distribution. Our measurements show that the submillimeter galaxies we have observed resemble scaled up version of the local Universe, ultra-luminous infrared galaxies (ULIRG) population. Their central densities and potential well depths are comparable to those of elliptical galaxies or massive bulges. The submm galaxy properties fulfill the criteria of 'maximal' starbursts in which most of the initial gas reservoir of  $\sim 10^{11} M_{\odot}$  is converted to stars on a time scale  $\sim 10 t_{\text{dyn}} < 10^8$  years.



Left: Contour map of the 1.26mm continuum emission of SMMJ0431+4700, superposed on an I-band image from Ledlow et al. (2003). The synthesized beam has a FWHM of  $0.74'' \times 0.63''$ . Contours are in steps of 2,3,4...7 times the rms noise level in the map. CO 9-8 at 238.6 GHz contributes no more than about  $1\sigma$  to the peak source flux. H6 and H7 are two radio sources in the field. The Ly $\alpha$  redshift of H6 is 3.349, our CO redshift of H7 is 3.346, showing that H6 and H7 are located in the same physical structure with a projected separation of  $\sim 25$  kpc and a velocity difference of  $\sim 200$  km/s. Right: CO 4-3 integrated emission from H7. The velocity scale is relative to  $z=3.346$ .

### Publications from this work:

- Genzel, R., Baker, A.J., Tacconi, L.J., Lutz, D., Cox, P., Guilloteau, S., Omont, A. 2003, ApJ, 584, 633
- Tacconi, L.J., Neri, R., Genzel, R., Ivison, R.J., Bertoldi, F., Blain, A., Chapman, S.C., Cox, P., Greve, T., Omont, A., Smail, I. 2004, ApJ, submitted

In collaboration with: F. Bertoldi, A. Blain, S. Chapman, P. Cox, T. Greve, R. Ivison, R. Neri, A. Omont, I. Smail