Molecular Gas, Dust, and Star Formation in Galaxies
Proceedings IAU Symposium No. 292, 2012
T. Wong & J. Ott, eds.

doi:10.1017/S1743921313001051

Molecular Gas and Star-formation in Selected H-ATLAS SDP Lensed SMGs

Lerothodi L. Leeuw[1,2], Dominik A. Riechers[3,4], John M. Carpenter[3], Mattia Negrello[5], Rob J. Ivison[6,7] and H-ATLAS Lensing and Core

[1]College of Graduate Studies, UNISA, P. O. Box 392, UNISA, 0003, South Africa
[2]SETI Institute, 189 Bernardo Avenue, Suite 100, Mountain View, CA 94043, USA
email: lerothodi@alum.mit.edu

[3]Astronomy Department, California Institute of Technology, MC 249-17, 1200 East California Boulevard, Pasadena, CA 91125, USA; [4]Hubble Fellow
email: dr@astro.caltech.edu

[5]Open University, Milton Keynes, MK7 6AA, United Kingdom

[6]UK Astronomy Technology Centre, Royal Observatory, Blackford Hill, Edinburgh EH9 3HJ

[7]Institute for Astronomy, University of Edinburgh, Blackford Hill, Edinburgh EH9 3HJ, UK

Abstract. We present detections of spatially resolved CO($J=2\rightarrow1$) and CO($J=3\rightarrow2$) emission, respectively, from the lensed submillimeter (submm) galaxies (SMGs), ID 9 ($z = 1.577$) and ID 17b ($z = 2.308$), found in the Science Demonstration Phase (SDP) of the *Herschel* Astrophysical Terahertz Large Area Survey (H-ATLAS, www.h-atlas.org). The detections were obtained using the Combined Array for Research in Millimeter-wave Astronomy (CARMA, www.mmarray.org) and confirm redshifts of the lensed galaxies. We exploit the CARMA data together with existing high-J observations, to determine, among other physical properties of the lensed SMGs, the CO line luminosities, brightness temperature ratios, gas masses, and spatial sizes.

Keywords. galaxies: distances and redshifts — galaxies: ISM — gravitational lensing — molecular data — submillimeter

Synopsis

We summarize high significance ($> 10\sigma$) detections of CO($J=2\rightarrow1$) and CO($J=3\rightarrow2$) line emission toward the lensed submillimeter (submm) galaxies (SMGs) ID 9 ($z=1.577$) and ID 17b ($z=2.308$), that were discovered in the *Herschel* Astrophysical Terahertz Large Area Survey (H-ATLAS, www.h-atlas.org). The detections were obtained with the Combined Array for Research in Millimeter-wave Astronomy (CARMA, www.mmarray.org) and are spatially resolved. From Gaussian fitting to the spatially integrated line profiles, we obtain CO($J=2\rightarrow1$) and CO($J=3\rightarrow2$) line peaks of 19.4 ± 2.2 mJy (ID 9), 38.6 ± 3.8 mJy (ID 17b, component 1) and 13.1 ± 3.1 mJy (ID 17b, component 2) with line FHWM of 371 ± 52, 157 ± 26 and 248 ± 73 km s^{-1}. From the fits, we also find redshifts of 1.5746 ± 0.0002 (ID 9), 2.3047 ± 0.0001 (ID 17b, component 1), and 2.3070 ± 0.0003 (ID 17b, component 2). The line parameters correspond to velocity-integrated emission line strengths of 7.63 ± 0.91 and 9.87 ± 1.22 Jy km s^{-1}, and line luminosities of $L'_{\rm CO(2-1)} = (2.48\pm0.29)\times10^{11}\,(\mu_{\rm L})^{-1}$ K km s^{-1} pc^2 and $L'_{\rm CO(3-2)} = (2.85\pm0.35)\times10^{11}\,(\mu_{\rm L})^{-1}$ K km s^{-1} pc^2 (where $\mu_{\rm L}$ is the lensing magnification factor) for ID 9 and ID 17b, respectively. The detections will be used to estimate, among other physical properties, the total molecular gas masses, spatial sizes, and star-formation efficiencies of the SMGs and compared to those of similar objects in the context of evolutionary galaxy models.