Manuel Aravena (Universidad Diego Portales, faculty/staff)

M. Aravena, and the SPT SMG collaboration

**Presentation Requested: oral**

**Category:** Evolution of the Interstellar Medium and Star formation over Cosmic Time

**Question:** What have we or will we learn about the chemical evolution of galaxies over cosmic time with ALMA, JWST and other telescopes? Is there a metallicity density w/ redshift relationship? What molecular and atomic species have we detected with ALMA and how have they helped us better understand the composition and evolution of galaxies?

**The properties of the ISM in the dusty star-forming galaxies at z=2-6 discovered by the SPT**

The South Pole Telescope (SPT) unveiled a population of rare gravitationally lensed, highly magnified, submillimeter galaxies (SMGs) in a deep mm wavelength survey over 2500 deg$^2$ the sky. In order to investigate the properties of the ISM of these sources, we have conducted a systematic multi-wavelength follow-up campaign with ALMA, APEX, ATCA, Herschel and the Hubble Space Telescope. In this talk, we will present a summary of our most recent results. In the first continuum imaging and blind CO-based redshift survey of a sample of 26 SPT SMGs with ALMA, we conclusively demonstrated the lensed nature of these sources and determined their redshifts, including some of the most distant SMGs known, at $z=5.7$. We have recently demonstrated the feasibility of detecting emission from faint molecular lines in stacked ALMA band-3 spectra and thereby measured the average properties of the ISM in these galaxies. Furthermore, we have obtained observations of [CII] and low-J CO line emission for a statistical sample of these sources. We show a comparison between [CII], CO(1–0), $L_{rmFIR}$ and $T_d$ for these high-redshift galaxies, and argue that some of the previous measurements might have been biased due to the use of $J > 3$ CO lines. Finally, we present our first resolved CO images of some of these sources obtained with ATCA.