MEASURING THE DISTRIBUTION AND EXCITATION OF COMETARY VOLATILES WITH ALMA.
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Introduction: Comets are frozen relics that contain ice, dust and debris from the time of formation of the Solar System. Thus, their compositions can reveal information on the physical and chemical properties of the Solar Nebula and protosolar disk, including the inventory of simple and complex organic molecules. There are significant gaps in our understanding of cometary compositions however, limited in part by a lack of information concerning the physical and chemical structure of the coma, particularly at radial distances less than a few thousand km from the nucleus.

Observational data: Here, we briefly summarise some early results from our study exploiting the unprecedented resolution and sensitivity of ALMA to provide the first maps of the distribution and temperature of CH_3OH in the inner coma of comet C/2012 K1/PanSTARRS. The first cometary observations with ALMA were reported by Cordiner et al. (2014), who performed measurements of the distributions of gas and dust in the inner comae of comets C/2012 F6 (Lemmon) and C/2012 S1 (ISON). In June 2014, 5.7 hours of ALMA observations were carried out, to obtain detailed multi-line maps of CH_3OH emission from comet C/2012 K1 (PanSTARRS).

Results: Spatially and spectrally resolved CH_3OH data cubes will be presented. Our observations probe the dense, inner region of the coma where the assumption of LTE is expected to hold. Our preliminary analyses of these data indicate significant variations in CH_3OH excitation temperature over spatial scales ~500 km and the peak temperature of falls by more than a factor of two within ~1000 km of the nucleus.

References: [1] Cordiner, M. A., Remijan, A. J., Boissier, J. et al. 2014, ApJ, 792, L2