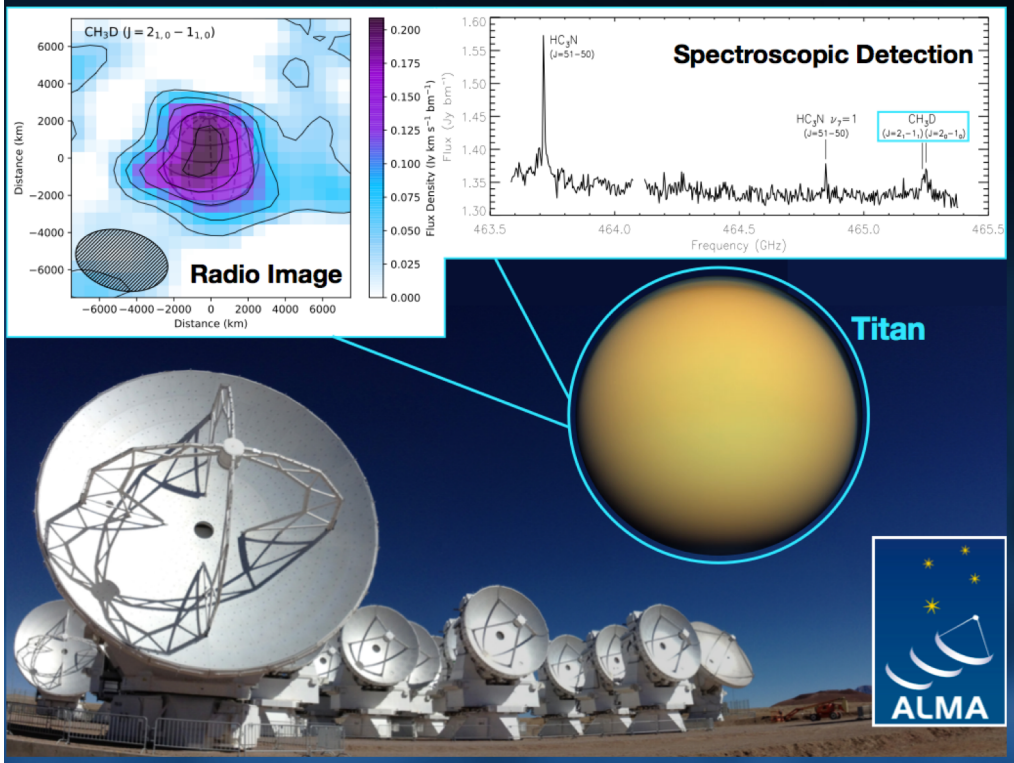
NASA ASTROBIOLOGY INSTITUTE

Measuring Titan's Methane from Earth



(Bottom) The ALMA telescope in Chile. (Middle) Saturn's largest moon, Titan, as seen from the Cassini spacecraft. (Top left): A radio image of Titan's CH_3D taken with ALMA. (Top right): The submillimeter spectrum of CH_3D. (Images from NRAO/ESA/NAOJ; NASA/JPL-Caltech/SSI; this work.)

Following the end of the successful Cassini/Huygens mission, ground-based observations in the submillimeter wavelength range are now helping to answer outstanding questions on the composition and variability of Titan's complex atmosphere.

- Saturn's largest moon, Titan, has a substantial atmosphere mostly composed of methane (CH_4) and molecular nitrogen (N_2). These gases react with ions and solar radiation to create a wealth of organic trace constituents.
- Many of Titan's atmospheric species vary with latitude and time throughout Titan's ~29.5 year seasonal cycle. However, variations in methane are still poorly understood, despite its importance in Titan's atmospheric chemistry.

- We have detected an isotope of CH_4 (CH_3D) in Titan's atmosphere using the Atacama Large Millimeter/submillimeter Array (ALMA), a telescope comprised of 66 individual antennas in the Atacama Desert in Chile. This is the first detection of CH_3D at submillimeter wavelengths, and allows for monitoring of Titan's global methane distribution, and its seasonal variability in the post-Cassini era.

A. E. Thelen et al., *The Astronomical Journal,* 157 (6), 219 (2019).