Measuring Titan’s Methane from Earth

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 ($\text{CH}_4$) and molecular nitrogen ($\text{N}_2$). 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 $\text{CH}_4$ ($\text{CH}_3\text{D}$) 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 $\text{CH}_3\text{D}$ at submillimeter wavelengths, and allows for monitoring of Titan’s global methane distribution, and its seasonal variability in the post-Cassini era.