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**Overview:** We have made a sensitive spectroscopic search for the small cyclic molecules pyridine ($C_5H_5N$) and pyrimidine ($C_4H_4N_2$) in Titan's atmosphere using the ALMA (Atacama Large Millimeter-Submillimeter) telescope. To date, no N-substituted rings have previously been detected in space: finding such molecules has profound astrobiological importance, as pyrimidine (c-$C_4H_4N_2$) forms the backbone ring for two of the four nucleobases (thymine and cytosine). Our observations did not detect these molecules, and data analysis is ongoing to determine upper limits, important for constraining photochemical models and thereby our understanding of the formation of prebiotic molecules in Titan's atmosphere.

**Background:** Titan's atmosphere is rich in organic molecules, created by the action of solar UV photons and charged particles from Saturn's magnetosphere acting on the main atmospheric gases, $N_2$ (98%) and $CH_4$ (2%) [1]. These primary ingredients are broken apart and recombined to form a plethora of hydrocarbons ($C_nH_m$) and nitriles ($C_nH_mCN$) [2], plus some oxygen-bearing species (CO, $CO_2$, $H_2O$) by incorporating $O^+$ from Enceladus [3]. The largest known molecule on Titan pre-Cassini was benzene (c-$C_6H_6$), detected by ISO in the middle infrared [4] at 674 $cm^{-1}$. After the arrival of Cassini in 2004, the Composite Infrared Spectrometer (CIRS, [5]) mapped the spatial distributions of many trace gases [6,7,8] in the neutral atmosphere including benzene, but detected only one new molecule: propene ($C_3H_6$) [9].

In contrast, the Cassini Ion and Neutral Mass Spectrometer (INMS), by direct sampling of the ionosphere, showed the presence of many new molecules reaching masses of 100 Daltons and beyond [10]. Tentative detections were made of $C_6H_2$, $C_7H_8$, $C_2H_3CN$, $C_2H_5CN$, $C_5H_5N$ and $NH_3$, via a signal at the mass of their protonated ions (e.g. $NH_3H^+$ at mass 18). However, Cassini's simple mass spectrometer can at best infer molecular formula, but cannot distinguish between isomers. Spectroscopy can resolve this ambiguity: hence it was the CIRS infrared detection of propene in the lower atmosphere that informed whether INMS had likely measured protonated propene ($CH_3CHCH_2H^+$) or cyclopropane (c-$C_3H_6H^+$) at mass 43 in the ionosphere. More recently, the first new spectroscopic identication with ALMA of a molecule on Titan has been made by members of our team [11], confirming the presence of $C_2H_5CN$. Another intriguing case in the INMS data is $C_5H_5NH^+$, which could be a protonated form of pyridine, a molecule with large astrobiological signicance, or an aliphatic isomer e.g. $CH_3CH_2C_2CN$. Pyridine is plausible since we already know that another cyclic molecule, benzene, is present.

**Observations and Data Analysis:** Titan was observed twice on March 2nd and again on March 4th, 2016, for a total time of ~3 hours in four spectral windows in ALMA Band 6, with a spectral resolution of 488 kHz. Modeling was conducted using the NEMESIS radiative transfer computer model [12] with molecular spectroscopic parameters for the cyclic molecules derived from published laboratory and theoretical work [13-15]. Initial analysis shows evidence of known nitriles such as acetonitrile and propionitrile, but emissions of the N-heterocycles were not observed. Efforts are ongoing to improve signal-to-noise ratio by combining datasets and to determine upper limits for these astrobiologically important species.

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