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Nitrogen fractionation in the atmospheres of Pluto and Titan – implications for the origin of nitrogen in KBOs and comets

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Recent observations of the composition of Pluto's atmosphere made by the Alice Ultraviolet Spectrometer on New Horizons and by the Atacama Large Millimeter Array (ALMA) have shown that Pluto's nitrogen chemistry differs significantly from that observed in Titan's upper atmosphere. The isotope ratios, 14N/15N, in N2 and HCN in Titan's atmosphere are 167.6 and ∼68, respectively. They differ by more than a factor of two because photodissociation of molecular nitrogen in Titan's atmosphere leads to a significant enrichment of the heavy nitrogen isotope, 15N, in HCN. However, ALMA observations were not able to detect HC15N in Pluto's atmosphere, setting a lower limit of 125 for 14N/15N in HCN. We have applied our model for simulating nitrogen isotope chemistry in Titan's atmosphere to Pluto, constrained by New Horizons observations, and explore possible explanations of the lower limit provided by ALMA. These results have implications for the origin of nitrogen on Pluto, other Kuiper Belt Objects (KBOs), and for comets like the Rosetta mission target 67P/Churyumov-Gerasimenko, which is thought to originate in the Kuiper Belt.