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Titan's Atmosphere: Deuterium and Noble Gases

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Two values of D/H have been reported for gases in Titan's atmosphere: in CH4 D/H = 1.32 +0.15/-0.13 x 10-4 , while in H2 , D/H = 2.3 $\pm$ 0.5 x 10-4 . Coustenis et al. have proposed that this discrepancy can be explained by an enrichment of D/H in the H2 produced by photolysis of CH4 . We offer an alternative: mixing of H2 from CH4 with H2 from Titan's interior. The H2 is produced by water-rock reactions. This hypothesis is consistent with measurements of D/H in H2O from comets, provided that both cometary and Titan ice are proto-solar.
The absence of Kr and Xe in the Huygens GCMS spectra has been interpreted as evidence of some special process(es) acting to deplete these gases in Titan's atmosphere. We show that for every known reservoir of noble gases in the solar system, the upper limits of 10-8 on mixing ratios of Kr and Xe established by the GCMS preclude the detection of these two gases. Hence there is no requirement for any special process(es) to explain the observations.