Abstract Submitted
for the TSF10 Meeting of
The American Physical Society

Time-history of the isotopic ratios in Titan's atmosphere KATHLEEN MANDT, HUNTER WAITE, JARED BELL, BRIAN MAGEE, Southwest Research Institute — Saturn's moon Titan is the only moon with a significant atmosphere, with a surface pressure of 1.5 times the surface pressure of Earth's atmosphere. The main constituents of Titan's atmosphere are molecular nitrogen (98%) and methane (1.4%). Diffusion, escape and chemical processes fractionate the isotopic ratios $^{14}N/^{15}N$ in N_2, $^{12}C/^{13}C$ in CH_4, and D/H in CH_4. Diffusion and escape result in a preferential loss of the lighter isotopes. Photochemistry may result in loss of the lighter isotopes in CH_4, but has been shown to have the opposite effect for N_2. A model constructed (Mandt et al. 2009) to track the isotopic ratios as a function of geologic time found that the $^{14}N/^{15}N$ in N_2 could not have evolved from the terrestrial ratio to its current value as a result of atmospheric escape, and that the $^{12}C/^{13}C$ measured in CH_4 limited the length of time for methane to have consistently resided in the atmosphere to less than 200 million years. Recent reanalysis of the Huygens GCMS data from Titan's surface (Niemann et al. 2010) has revised the $^{14}N/^{15}N$ in N_2 and $^{12}C/^{13}C$ in CH_4, resulting in significant changes to model results for the evolution of methane. We will present these updated results on the evolution of Titan's atmosphere and discuss the implications for the history of Titan. Mandt, K. E., et al., 2009, Planetary and Space Science, 57, 1917-1930. H.B.Niemann, et al., 2010. J. Geophys. Res., in press

Kathleen Mandt
Southwest Research Institute

Date submitted: 22 Sep 2010 Electronic form version 1.4