P140-020 **Room: 304** **Time: May 19 9:15-9:30**

The origin of N2 in Titan's atmosphere: the role of impact devolatilization of Titan's icy crust

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Titan has a thick atmosphere composed primarily of N2. One of the most puzzling aspects of Titan's atmosphere is the origin of N2 because of the near absence of non-radiogenic noble gases in the atmosphere, highly suggestive of that the nitrogen was captured as NH3 and other non-N2-bearing compounds in the satellitesimals. Although several studies have investigated the mechanism responsible for converting NH3 to N2 in the primitive atmosphere of Titan [Mckay et al 1988, Atreya et al 1978], it is still unclear how and when the production of N2 has occurred.

In this study, we assess the role of shock-induced devolatilization of Titan's icy crust by hypervelocity impacts of cometary bodies for the origin of N2 in the atmosphere. Although the chemical compositions of Titan's crust are still uncertain, NH3-ice [Nelson et al 2008] and ammonium sulfate [Fortes et al 2007] are considered as major components. To investigate whether the conversion of NH3-ice and ammonium sulfate to N2 occur or not by cometary impacts, we conducted laboratory experiments of hypervelocity impact using a laser gun. We used gold (Au) foils, varied thickness to vary impact velocity, as impactors, and isotopic-labeled(15N) ammonium sulfate and NH3-H2O ice (50% of NH3) as targets.

We experimentally obtain the efficiency of 15N2 production as a function of the peak shock pressure. We found that N2 production begins at about 10 GPa of the peak shock pressure, and that the efficiency of N2 production linearly increases with the peak shock pressure. When considering the peak shock pressure achieved in Titan's crust by impacts of planetesimals and comets, our experimental results suggest that N2 production from ammonium sulfate and NH3-ice in Titan's crust takes place efficiency in these impacts. Furthermore, using our experimental data of the efficiency of N2 production, we estimate the total amount of N2 produced by cometary impacts over 4.5 Gyr on Titan. The estimated value of N2 production in our study shows that a large part of or almost all the present amount of N2 could have been derived from the devolatilization of Titan's crust by cometary impacts.