Enabling Technologies for DeepCryo Volatiles Experimentation and Exploration

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This presentation will provide highlights of the results and information presented at the 1st and 2nd International Lunar Superconductor Applications workshop held in March 2011 and 2012 in Houston, Texas in association between Flexure Engineering and the Texas Center for Superconductivity at the University of Houston (TcSUH). This presentation will also outline the proposed Lunar Volatiles Dynamic Chamber proposed by Flexure Engineering.
(see lsa2013.com to download proceedings)

We believe that the discovery of extensive terrains and large volumes of DeepCryo (20K - 120K) volatile ices at the Lunar poles represents a fundamentally new discovery in planetary science and an new opportunity for technological advancement for exploration and ISRU activities at the Moon and beyond. Now that it has been proven by LRO Diviner and LCROSS that rich, complex deposits exist in close proximity to the Earth there is an imperative to study, explore and eventually utilize these deposits.

While it is true that the basic chemical and physical processes in DeepCryo conditions are well understood from theory and experimentation at higher cryogenic temperatures, there are macroscopic quantum mechanical processes such as high temperature superconductivity and the very high thermal conductivity of substances such as sapphire and beryllium that only express themselves in true DeepCryo conditions. These macroscopic quantum mechanical processes are typically controlled (enhanced or quenched) by 2D structures in the bulk material. Lunar rocks and soils are rich in complex 2D structures containing minerals (and now volatiles) not well studied or easily reproduced in terrestrial labs. It is therefore reasonable to believe that there may be new processes not yet dreamed of or discovered.

To explore these potentially new processes on Earth we will need complex experimental systems that operate for long periods of time at DeepCryo conditions to first grow then study the volatile complexes of interest.

To explore the potentially billion year old ice deposits at the Lunar poles we will need rovers, drills, and autonomous laboratories that operate without consuming or producing excess power and heat that would interfere with the exploration or utilization of Lunar resources.

The Lunar Superconductor Applications workshops where created to provide a venue to share results and explore the new technologies and techniques needed to create the terrestrial experiments and eventually the flight hardware to unlock the secrets the Lunar poles have to offer.