**New Horizon of Physics using Pressure**

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Pressure is a physical parameter exploring new properties of elements in a periodic table. Combined with temperature, we can modify physical and chemical properties of elements and even create new materials under so-called “extreme conditions”. Recent reports of metallic-molecular hydrogen at 495 GPa [1], room temperature superconductivity from LaH10 [2] are good examples of discovery of new properties under high pressure, in addition to the synthesis of diamond from carbon which is well known to us. Theoretical calculations predict that super-high energy density materials can be made at high temperature and pressure, also.

In this talk, I will start with the introduction of studies of high pressure including techniques of sample preparation in a diamond anvil cell, measurements of properties at extreme conditions, analytical tools, and will present our recent results on high density hydrogen energy materials under high pressure of hydrogen. Results of structural analysis on potassium polyhydrides under high pressure of hydrogen (~ 80 GPa) at high temperature (~2000 K) irradiated by using a laser-heating system will be also discussed.

[1] Ranga P. Dias, Isaac F. Silvera, DOI: 10.1126/science.aal1579 (2017)  
[2] M. Somayazulu, R. J. Hemley, Phys. Rev. Lett., 122, 027001 (2019)