Raman spectroscopy measurement of MoS$_2$ to 43 GPa$^1$
YANZHANG MA, Texas Tech University, BOHENG MA, Thomas S. Wootton High School, HONGYANG ZHU, MING CHYU, Texas Tech University — MoS$_2$ has a typical layered crystal structure. The two-dimensional lattice vibration, in conjunction with the strong (ionic) and weak (Van de Waals) bonding, is a very interesting subject. Among many of the interesting properties of MoS$_2$ is the physical performance in response to the substantial reduction of distance between the layers of the MoS$_2$ network along with the increase of interaction between them. We compressed MoS$_2$ in a diamond anvil cell to 43 GPa and carried out in situ Raman spectroscopy measurement. We found that the vibration energy of the A$_{1g}$ and E$_{2g}$ modes was elevated with increasing pressure. At about 27 GPa, the peak of E$_{2g}$ mode split into two peaks while the A$_{1g}$ peak did not show any abnormality. We believe that this reflects a structural phase transformation due to a minimal distortion of the MoS$_2$ network within the layer. We also found that non-hydrostatic compression on the sample lowered the pressure-induced energy elevation of the vibration modes, indicating that the differential stress applied on a MoS$_2$ crystal resists the atomic vibration.

$^1$This work is supported by NSF grant number: DMR0619215