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Nanowire Ice of Phase VI and Distorted VII in Mesoporous Silica Nanotorus Superlattice[1] JINLONG ZHU, JIANZHONG ZHANG, YUSHENG ZHAO, Los Alamos National Lab — The motivation of nano H_2O realization and characterization is the highly polarized nature of H_2O molecules and the spatial hydrogen bonded networks both in liquid and solid form. The hydrogen bonding character of water molecules results in a remarkably rich phase diagram in the pressure-temperature space. Water/Ice confined in nanochannels showed novel structures and properties as results of hydrophobic and hydrophilic interactions and hydrogen bonding interaction between water molecule and the surface of nanochannel. Studies on nano H_2O can provide potential pathway to understand the complicated structure evolutions of ice in the P-T space, because the interplay between nano-confinement and strong intermolecular hydrogen interactions can lead to even richer ice structures which were not found in the none-confined bulk form. The high pressure experiment indicated that the pressure of nanowire ice VI and VII shifted up to 1.7 GPa and 2.5 GPa, and about $\sim$ 0.65 GPa and 0.4 GPa higher than that of normal ice. The nano size effect and the strength of mesoporous silica nanotorus are responsible for the pressure shifts of ice phase regions. More pronounced, the cubic ice VII changed into a tetragonal distorted "psuedocubic" structure of the nanowire ice when confined in the mesoporous tubes. The degree of tetragonality increased with increasing pressure, which is resulted from the uniaxial pressure nanowire ice felt, and the anisotropic hydrogen bonding interactions including the H_2O-H_2O hydrogen bonds in the bulk of the ice and the H_2O-silica –OH hydrogen bonds between the interface of nanowire ice and mesoporous silica.

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