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Optical Signature of Metallization of Hydrogen R.E. COHEN, Geophysical Lab, Carnegie Institution and UCL, IVAN NAUMOV, RUSSELL J. HEMLEY, Geophysical Lab, Carnegie Institution — All proposed high-pressure structures of hydrogen are based on distorted graphene-structured, honeycomb layers. These give unique signatures for metallization and optical response [1,2]. Theoretical calculations and an assessment of recent experimental results for dense solid hydrogen lead to a unique scenario for the metallization of hydrogen under pressure. The metallization of hydrogen is very different from that originally proposed via a phase transition to a close-packed monoatomic structure, and different from simple metallization recently used to interpret recent experimental data. These different mechanisms for metallization have very different experimental signatures. We show that the shift of the main visible absorption edge does not constrain the point of band gap closure, in contrast with recent claims. This conclusion is confirmed by measured optical spectra, including spectra obtained to low photon energies in the infrared region for phases III and IV of hydrogen. This work was supported as part of EFree, an Energy Frontier Research Center funded by the US Department of Energy.

[1] Naumov, I.I., R. E. Cohen, and R. J. Hemley, PRB **88**, 045125 (2013).
[2] Cohen, R. E., I. I. Naumov, and R. J. Hemley, PNAS **110** 13757 (2013).

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