Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Nanoshells as a high-pressure gauge JACQUES TEMPERE, NICK VAN DEN BROECK, KATRIJN PUTTENEERS, Universiteit Antwerpen, ISAAC SILVERA, Harvard University — Nanoshells, consisting of multiple spherical layers, have an extensive list of applications, usually performing the function of a probe. We add a new application to this list in the form of a high-pressure gauge in a Diamond Anvil Cell (DAC). In a DAC, where high pressures are reached by pressing two diamonds together, existing gauges fail at higher pressures because of calibration difficulties and obscuring effects in the diamonds. The nanoshell gauge does not face this issue since its optical spectrum can be engineered by altering the thickness of its layers. Furthermore their properties are measured by broad band optical transmission spectroscopy leading to a very large signal-to-noise ratio even in the multi-megabar pressure regime where ruby measurements become challenging. Theoretical calculations based on the Maxwell equations in a spherical geometry combined with the Vinet equation of state show that a three-layer geometry (SiO_2-Au-SiO_2) indeed has a measurable pressure-dependent optical response desirable for gauges.

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Date submitted: 08 Nov 2011 Electronic form version 1.4