Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

**Mechanical properties of 3D printed warped membranes** ANDREJ KOSMRLJ, KECHAO XIAO, JAMES C. WEAVER, JOOST J. VLASSAK, DAVID R. NELSON, Harvard University — We explore how a frozen background metric affects the mechanical properties of solid planar membranes. Our focus is a special class of "warped membranes" with a preferred random height profile characterized by random Gaussian variables $h(q)$ in Fourier space with zero mean and variance $< |h(q)|^2 > \sim q^{-m}$. It has been shown theoretically that in the linear response regime, this quenched random disorder increases the effective bending rigidity, while the Young's and shear moduli are reduced. Compared to flat plates of the same thickness $t$, the bending rigidity of warped membranes is increased by a factor $\sim h_v/t$ while the in-plane elastic moduli are reduced by $\sim t/h_v$, where $h_v = \sqrt{< |h(x)|^2 >}$ describes the frozen height fluctuations. Interestingly, $h_v$ is system size dependent for warped membranes characterized with $m > 2$. We present experimental tests of these predictions, using warped membranes prepared via high resolution 3D printing.

Andrej Kosmrlj
Harvard University

Date submitted: 13 Nov 2014 Electronic form version 1.4