Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

**Hydrogen-free amorphous silicon with no tunneling states**[1] XIAO LIU, Naval Research Laboratory, DANIEL QUEEN , NRC Postdoctoral Associate, THOMAS METCALF , Naval Research Laboratory, JULIE KAREL , Department of Physics, University of California, Berkeley, FRANCES HELLMAN , Department of Physics and Department of Materials Science and Engineering, University of California, Berkeley — The ubiquitous low-energy excitations, known as the two-level tunneling systems (TLS), are one of the universal phenomena of amorphous solids. These excitations dominate the acoustic, dielectric, and thermal properties of structurally disordered solids. One exception has been a type of hydrogenated amorphous silicon (a-Si:H) with 1 at.% hydrogen. Using low temperature elastic measurements of electron-beam evaporated amorphous silicon (a-Si), a model monatomic amorphous system, we show that TLS are also diminished in this system as the films become denser and more structurally ordered. Our results demonstrate that TLS are not intrinsic to the glassy state but instead reside in low density regions of the amorphous network. This work obviates the role hydrogen was previously thought to play in removing TLS in a-Si:H and favors an ideal four-fold covalently bonded amorphous structure as the cause for the disappearance of TLS. Our result supports the notion that a-Si can be made a "perfect glass" with "crystal-like" properties, thus offering an encouraging opportunity to use it as a simple crystal alternative in applications, such as in modern quantum devices where TLS are the source of dissipation, decoherence and 1/f noise.

[1]Work supported by the Office of Naval Research

Xiao Liu
Naval Research Laboratory

Date submitted: 15 Nov 2013 Electronic form version 1.4