Abstract Submitted
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Investigation of phonon-like excitation in hydrated protein powders by neutron scattering[1] XIANG-QIANG (ROSIE) CHU, Wayne State University, EUGENE MAMONTOV, HUGH O'NEILL, QIU ZHANG, ALEXANDER KOLESNIKOV, Oak Ridge National Laboratory — Detecting the phonon dispersion relations in proteins is essential for understanding the intra-protein dynamical behavior. Such study has been attempted by X-ray in recent years [1,2]. However, for such detections, neutrons have significant advantages in resolution and time-efficiency compare to X-rays. Traditionally the collective motions of atoms in protein molecules are hard to detect using neutrons, because of high incoherent scattering background from intrinsic hydrogen atoms in the protein molecules. The recent availability of a fully deuterated green fluorescent protein (GFP) synthesized by the Bio-deuteration Lab at ORNL opens new possibilities to probe collective excitations in proteins using inelastic neutron scattering. Using a direct time-of-flight Fermi chopper neutron spectrometer, we obtained a full map of the meV phonon-like excitations in the fully deuterated protein. The Q range of the observed excitations corresponds to the length scale close to the size of the secondary structures of proteins and reflects the collective intra-protein motions. Our results show that hydration of GFP seems to harden, not soften, the collective motions. This result is counterintuitive but in agreement with the observations by previous neutron scattering experiments [3].

[1] PRL 101, 135501 (2008).
[2] Soft Matter 7, 9848 (2011).
[3] J. Phys. Chem. B 113, 5001 (2009).

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