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Terahertz Dielectric Response of Photoactive Yellow Protein (PYP): Influence of Conformational-Vibrational State during Photocycle and Hydration Effects JOSEPH KNAB, JING-YIN CHEN, Physics Department, University at Buffalo, Buffalo, NY 14260, WOUTER HOFF, Department of Microbiology and Molecular Genetics, Oklahoma State University, Stillwater, OK 74078, ANDREA MARKELZ, Physics Department, University at Buffalo, Buffalo, NY 14260 — Protein conformational change alters flexibility and conformational-vibrational modes that occur on a picosecond or sub-picosecond time scale. Terahertz dielectric measurements are sensitive to protein flexibility as they directly probe the density of states of these vibrational modes. Using terahertz time-domain spectroscopy, we measured the dielectric response of PYP thin films as a function of resting and photointermediate state. The absorbance increases smoothly as a function of frequency while the index of refraction exhibits no frequency dependence. A sharp transition in the dielectric response of the ground state is observed at 86% relative humidity (r.h.), corresponding to the point where the protein film has lost ~ 50 water molecules relative to a 100% r.h. environment. Similar transitions observed for hen egg white lysozyme and cytochrome c correspond to the filling point of the first hydration shell.

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