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Dynamical Transition of the Protein Observed in Terahertz Dielectric Response JING-YIN CHEN, JOSEPH KNAB, ANDREA MARKELZ, Physics Department, University at Buffalo, SUNY, Buffalo, NY 14260 — Temperature dependent measurements (10 K – 296 K) were made of the terahertz dielectric response of oxidized and reduced cytochrome C (CytC) buffer solutions using THz time domain spectroscopy (THzTDS) (0.12-2.0 THz) . The imaginary part of the index (κ) for both ferri and ferro CytC solutions increases linearly with temperature at low temperatures and then strongly increases near 200 K with a plateau at 250 K. The change of κ for ferroCytC between 200 K and 250 K is nearly half that of ferriCytC. The result is consistent with Mossbauer measurements; however THzTDS measures motions in the significantly shorter time range, 0.5 – 8 ps. These are the first measurements of the transition in the THz range and put constraints on allowed mechanisms. The agreement with polarizability insensitive Mossbauer supports that the dramatic increase in the THz dielectric response with oxidation we reported for CytC films (Phys Rev E 72, 040901 (2005)) results mainly from a large increase in the low frequency vibrational density of states. Work was supported by NSF Career PHY-0349256, and NSF IGERT DGE0114330.

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