Global Picosecond Structural Dynamics of Orange Carotenoid Protein in Photo/Chemical Activated Signaling States[1] YANTING DENG, MENGYANG XU, State Univ of NY , HANJUN LIU, ROBERT BLANKENSHIP, Washington Univ., St. Louis, ANDREA MARKELZ, State Univ of NY — Light availability to photosynthetic organisms changes throughout the day. High light can over-saturate photosynthetic capacity and produce reactive oxygen which damages the photosynthetic apparatus and leads to cell death. Photosynthetic organisms have evolved multiple photo-protective strategies to prevent oxidative damage from light stress. For cyanobacteria, a blue-light photo-sensor orange carotenoid protein (OCP) responds to exposure to intense light. Upon high light stress, OCP converts from the orange inactive form (OCP^O) to the red active form (OCP^R), with a large conformational change. And OCP^R interacts with the light harvesting antenna phycobilisome (PB), and mediates the energy quenching of PB. We argue that both the susceptibility of OCP to large conformational change and its interaction with PB are associated with changes in the long range picosecond structural flexibility. To investigate the protein flexibility with signaling state dependence, temperature dependent terahertz time domain spectroscopy is performed in the range of $80 - 290$ K on OCP solutions, as a function of illumination and chaotrope (NaSCN) concentration, which produces a long lived red state in the absence of photoexcitation. We characterize the global flexibility by both the net THz absorbance and the dynamical transition temperature, which scales with structural stability, and observed the dynamical transition occurred in the 180-220 K range.

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