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**Harmonic Generation Spectroscopy of Enzymatic Activity in Live Organisms** JIE FANG, GUSTAVO CARDENAS, SHIH-YING HSU, WILLIAM WIDGE, JOHN MILLER, University of Houston — We report on measurements of harmonics generated by whole cells, chloroplasts, and whole plants in response to applied sinusoidal electric fields. The frequency- and amplitude-dependence of the induced harmonics exhibit features that correlate with physiological processes. In particular, we find that harmonics generated by whole plants and suspensions of chloroplasts are dramatically increased by the presence of light. Systematic studies of the second and third harmonic generation spectra of chloroplast suspensions indicate the following: 1) a broad peak, centered around 10 kHz applied frequency (20 kHz for the second harmonic) appears when the photosynthetic electron transport chain is activated by light in the presence of a suitable electron acceptor, such as ferricyanide; changes observed in the time-dependent harmonic response for fixed frequency are correlated to the presence of light activation of photosynthetic electron transport activity. 2) This feature correlates with oxygen evolution activity of photosynthesis. In whole plants, multiple peaks in the light-activated harmonic generation spectra suggest that the method may be able to selectively probe specific photosynthetic activity in plants.

Jie Fang  
University of Houston

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