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Plasmon-enhanced absorption in a metal nanoparticles and photosynthetic molecules hybrid system ZHIYUAN FAN, ALEXANDER GOVOROV, Department of Physics and Astronomy, Ohio University, OHIO UNIVERSITY TEAM — Photosystem I from cyanobacteria is one of nature's most efficient light harvesting complexes, converting light energy into electronic energy with a quantum yield of 100% and an energy yield about 58%. It is very attractive to the nanotechnology community because of its nanoscale dimensions and excellent optoelectronic properties. This protein has the potential to be utilized in devices such as solar cells, electric switches, photo-detectors, etc. However, there is one limiting factor for potential applications of a single monolayer of these photosynthetic proteins. One monolayer absorbs less than 1% of sunlight's energy, despite their excellent optoelectronic properties. Recently, experiments [1] have been conducted to enhance light absorption with the assistance of metal nanoparticles as artificial antenna for the photosystem I. Here, we present a theoretical description of the strong plasmon-assisted interactions between the metal nanoparticles and the optical dipoles of the reaction centers observed in the experiments. The resonance and off-resonance plasmon effects enhance the electromagnetic fields around the photosystem-I molecules and, in this way, lead to enhanced absorption.

[1] I. Carmeli, I. Lieberman, L. Kraversky, Zhiyuan Fan, A. O. Govorov, G. Markovich, and S. Richter, submitted.

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