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Laser-Induced Conductance Enhancement in Single-Molecule Junctions[1] E-DEAN FUNG, OLGUN ADAK, GIACOMO LOVAT, DIEGO SCARABELLI, LATHA VENKATARAMAN, Columbia Univ — Recent studies have demonstrated light-induced current enhancement in nano-scale junctions via photon-assisted transport and hot-electron transport. We use a non-equilibrium Green's function model to show that these two mechanisms have identical current-voltage characteristics and argue that hot-electron transport accounts for the majority of photocurrent for nanoscopic junctions operating in the visible and near-infrared spectrum. Using 4,4'-bipyridine bound to Au electrodes as a prototypical single-molecule junction, we report up to 60% enhancement in conductance by illuminating single-molecule junctions with 980 nm wavelength continuous wave laser. Furthermore, we probe the subtle effects of the transmission function on light-induced current and show that discrete variations in the binding geometry result in a significant change in conductance enhancement. This work provides a robust experimental framework for studying light-induced transport mechanisms in single-molecule junctions, which could lead to improved designs for organic optoelectronic devices.

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E-Dean Fung
Columbia Univ

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