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Electro-photonic enhancements in organic solar cells with photonic crystal photoactive layers JOHN TUMBLESTON, University of North Carolina - Chapel Hill, DOO-HYUN KO, EDWARD SAMULSKI, RENE LOPEZ — Organic photovoltaics with nanopatterned photonic crystal photoactive layers offer an alternative to conventional planar devices that suffer from a competition between optical absorption and electronic processes. Our recent studies have shown that nanopatterned devices exhibit enhanced absorption and exciton creation profiles as compared to planar cells. Improved absorption results in part from the excitation of resonant optical modes where certain photon energies near the semiconducting band edge are enhanced 20-fold. Prerequisites for their excitation include an index of refraction contrast of 0.3 for the two photonic crystal materials and a periodicity comparable to the band edge wavelength. Resonant mode dispersion determined via photonic band calculations and variable angle absorption measurements indicate that both fast and slow modes exist in nanopatterned devices. Quantum efficiency measurements also confirm improved optical and electrical performance for photonic crystal organic solar cells.

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