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**Electromodulation spectroscopy of high performance bulk-heterojunction solar cells** MARIAN TZOLOV, Department of Physics, Lock Haven University of Pennsylvania, ILIA IVANOV, Center for Nanophase Materials Sciences, Oak Ridge National Laboratory — The efficiency of polymer solar cells has significantly improved thanks to the excellent film forming properties of the fluorinated derivative PBDB-T-2F (PM6) combined with the efficient electron acceptor BTP-4F-12 (Y6-12). We have fabricated devices with inverted architecture exceeding efficiency of 10%, with the short circuit current and open circuit voltage comparable to top values in the literature. These devices were studied using electroabsorption (EA) spectroscopy, a technique which is sensitive to the interplay between light absorption and internal electric field. The current-voltage measurements in dark and under illumination before and after each EA measurement verify that the devices didn't degrade substantially during the experiment, and that the EA spectra are representative for high performing devices. We have followed the spectral variations with DC bias by calculating the EA dynamic spectra, the 2D synchronous and asynchronous correlation spectra. Our studies reveal substantial coupling of electron states below the absorption edge with the electric field, which is a feature not detectable in the absorption, and photocurrent spectra. We have found that the electronic states of mixed PM6:Y6-12 were modified relative to their pristine state. Details on this additional interaction may hold the explanation for the successful operation of polymer photovoltaic devices.

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