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Three-body Annihilation at the Onset of Anomalous Photocurrent Suppression in Vertical Heterostrucutres of $MoTe_2$ TREVOR ARP, Department of Physics, University of California Riverside, DENNIS PLESKOT, Department of Materials Science and Engineering, University of California Riverside, NATHANIEL GABOR, Department of Physics, University of California Riverside
— We have developed a new photoresponse imaging technique that utilizes extensive data acquisition over a large parameter space. By acquiring a multi-dimensional data set, we fully capture the intrinsic optoelectronic response of two-dimensional heterostructure devices. Using this technique we have investigated the behavior of heterostructures consisting of molybdenum ditelluride ($MoTe_2$) sandwiched between graphene top and bottom contacts. Under near-infrared optical excitation, the ultrathin heterostructure devices exhibit sub-linear photocurrent response that recovers within several dozen picoseconds. As the optical power increases, the dynamics of the photoresponse, consistent with 3-body annihilation, precede a sudden suppression of photocurrent. The observed dynamics near the threshold to photocurrent suppression may indicate the onset to a strongly interacting population of electrons and holes.

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