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Emergent Regulation of Energy Flow in a Two-Dimensional Semiconductor Nanoscale Heat Engine NATHANIEL GABOR, TREVOR ARP, YAFIS BARLAS, VIVEK AJI, University of California Riverside — Simple machines, including switches, axles, and motors, have recently been demonstrated at the molecular scale, and will likely revolutionize nanotechnology. The thermodynamic heat engine, one of the most important machines, may be critical in motivating this nanoscale revolution. We propose a nanoscale quantum heat engine based on two-dimensional semiconductor heterostructures composed of molybdenum diselenide and tungsten disulphide. Based on our recent theoretical work [1], we show that such heterostructures may exhibit emergent regulation of energy flow, which results from the internal quantum electronic structure. We describe the detailed electronic structure required for emergent regulation, and present preliminary characterization of this novel quantum heat engine. [1] Arp, et al. Nano Letters DOI: 10.1021/acs.nanolett.6b03136.

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