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Electrically controlled fluorescence quenching of quantum dots on monolayer Molybdenum Disulfide – Part I DHIRAJ PRASAI, ANDREY KLOTS, Department of Physics and Astronomy, Vanderbilt University, A.K.M. NEWAZ, Department of Physics and Astronomy, San Francisco State University, SCOTT NIEZGODA, NOAH ORFIELD, SANDRA ROSENTHAL, Department of Chemistry, Vanderbilt University, KANE JENNINGS, Chemical and Biomolecular Engineering, Vanderbilt University, KIRILL BOLOTIN, Department of Physics and Astronomy, Vanderbilt University — We study hybrid electronic structures in which zero-dimensional semiconductor quantum dots (QDs) are coupled with two-dimensional monolayer molybdenum disulfide (MoS_2). To fabricate such devices, we mechanically transfer MoS_2 onto a sub-monolayer of QDs assembled on a functionalized glass surface. We investigate quenching of the fluorescence of QDs which are selectively synthesized to have emission spectra which overlaps with the excitonic absorption peak (2.1eV) in MoS_2. Both photoluminescence intensity and lifetime for QDs on MoS_2 decrease ~ 5 times due to near-field energy transfer from QDs to MoS_2. Furthermore, by electrostatically gating MoS_2, we control the rate of energy transfer and modulate the photoluminescence intensity of QDs by $\sim 50\%$.

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