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Electrical Control of Optical Properties of a Two Dimensional Material, Monolayer Molybdenum Disulfide (MoS_2) A.K.M. NEWAZ, D. PRASAI, J.I. ZIEGLER, D. CAUDEL, Vanderbilt University, S. ROBINSON, Belmont University, R.F. HAGLUND, K.I. BOLOTIN, Vanderbilt University — Materials with electrically controllable optical properties are long sought for uses in diverse applications ranging from electro-optical modulators to display screens. Here we demonstrate electrical control of photoluminescence quantum yield and absorption coefficient in the visible range for a different two-dimensional crystal, monolayer molybdenum disulfide (MoS_2). We investigate electrical gating of photoluminescence and optical absorption in monolayer MoS_2 configured in field effect transistor geometry. We observe an hundredfold increase in photoluminescence intensity and an increase in absorption at $\sim$ 660 nm in these devices when an external gate voltage is decreased from +50 V to -50 V, while the photoluminescence wavelength remains nearly constant. In contrast, in bilayer MoS_2 devices we observe almost no changes in photoluminescence with gate voltage. We propose that the differing responses of the monolayer and bilayer devices are related to the interaction of the excitons in MoS_2 with charge carriers.

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