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Shot noise detection in hBN-based tunnel junctions PANPAN ZHOU, Department of Physics and Astronomy, Rice University, USA, WILL HARDY, Applied Physics Program, Smalley-Curl Institute, Rice University, USA, KENJI WATANABE, TAKASHI TANIGUCHI, National Institute for Materials Science, Japan, DOUGLAS NATELSON, Department of Physics and Astronomy, Rice University, USA — Shot noise, which originates from the discreteness of charge carriers, can provide more information about charge transport than the average current. The tunneling current noise in a normal single electron system is given by $S = 2eI$ when $eV \gg 2k_BT$. While in strongly correlated systems, where the electron Coulomb repulsion is not negligible, the shot noise might deviate from this classical result. Here we demonstrate a technique that can be adapted to study the shot noise in strongly correlated systems. High quality Au/hBN/Au tunneling devices are fabricated using transferred atomically thin hexagonal boron nitride as the tunneling barrier. All tunneling junctions show specific resistance on the order of several $k\Omega/\mu m^2$, which agrees with previous reported hBN-based tunnel junction properties. The ohmic-like $I - V$ curves at small bias range indicate the sparsity of defects. Tunneling current shot noise is measured in these devices and the excess shot noise shows great consistency with theoretical expectation. These results show that atomically thin hBN is an excellent tunneling barrier, especially for the study of shot noise properties, which might be a useful tool to study the charge transport properties in complicated systems.

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