Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Spin voltage generation across rare earth spin filter barriers[1]
GUOXING MIAO, MIT, JOONYEON CHANG, KIST, JAGADEESH MOODERA, MIT — When a metal is in close contact with a rare-earth based magnetic compound, strong exchange interaction exists between the localized 4f electrons and the free moving conduction electrons. One important consequence is that the spin degeneracy among the conduction electrons is lifted, showing up as an effective Zeeman splitting higher than tens of Tesla in low dimensional systems such as graphene and other 2DEG. We perform our work using a vertical transport geometry, which consists of double spin filtering barriers based on a ferromagnetic Eu chalcogenide - EuS. A thin Al metallic layer is sandwiched in the middle and its conduction electrons thus experience the strong spin splitting, which is subsequently detected via the spin filtering effect. A spontaneous spin dependent voltage appears across such a device, and its polarity is directly determined by the EuS/Al interface. The voltage level difference between the spin-parallel and -antiparallel configurations is as large as a few mV. Such spin splitting also induces a clear universal behavior in the observed TMR bias dependence. Such spin voltage effect offers a possibility of directly converting magnetic exchange energy into electrical power.

[1]This work is supported by NSF DMR 0504158, ONR N00014-06-1-0235, and KIST-MIT project funds.

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Date submitted: 08 Dec 2010 Electronic form version 1.4