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Polarization controlled Ohmic to Schottky transition at a metallic oxide-doped ferroelectric interface XIAOHUI LIU, YONG WANG, J.D. BURTON, EVGENY TSYMBAL, Department of Physics and Astronomy, University of Nebraska - Lincoln — Recently the coexistence of ferroelectricity and conductivity was observed in electron-doped $BaTiO_3$ [1], opening an exciting avenue for novel ferroelectric device applications. A basic structure which may be used for future applications is the metal/ferroelectric hetero-junction. Using first-principles methods and taking the $SrRuO_3/BaTiO_3$ interface as a prototypical system, we investigate the effects of polarization reversal in $BaTiO_3$ on the electronic transport across this interface. Our studies show a significant change in the resistance by switching ferroelectric polarization. This arises due to the polarization driven conversion of the interface from the Ohmic to the Schottky regime, i.e. for one polarization orientation the interface exhibits a tunneling barrier, whereas the interface is metallic for the opposite polarization orientation. Our prediction represents a new path for ferroelectric devices and may lead to exciting new applications as non-volatile memories and logic.

[1] T. Kolodiazhnyi et al, Phys. Rev. Lett. 104, 147602 (2010).

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