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Polar catastrophe by fractional charge differences

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Ab-initio calculations within density functional theory are used to investigate the electronic states at the stoichiometric SnO/SnO_2(110) interface. Although the interface lacks a polar discontinuity, we observe the formation of a two dimensional hole gas between wide band gap semiconductors. We explain the findings by providing a model based on the idea that the stoichiometry discontinuity between SnO and SnO_2 creates fractional charge differences, which in turn drive a polar catastrophe scenario.