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Polarization effect in the Ionic conductor TlBr[1]
CEDRIC ROCHA LEAO, VINCENZO LORDI, Lawrence Livermore National Laboratory — TlBr is an ionic crystal that in recent years has been standing out as one of the most promising materials for effective room temperature radiation detection. However, its exceptional performance invariably degrades after operation times that vary from hours to several weeks. This phenomenon, known as polarization, is assigned to the undesirable ionic current that sets in the crystal under an applied bias, leading to the accumulation of oppositely charged Tl+ and Br- ions at the electric contacts of the device. This charge build up induces a field that opposes the applied bias, impairing the collection of the photo-induced carriers. In this presentation, we use parameter free quantum mechanical simulations to discuss the possible origins of the polarization effect in TlBr, showing that ionic mobility in the intrinsic material is not enough to account for effects reported by several groups. We then discuss other possible causes for the degradation of biased TlBr and propose ways to prevent its occurrence, via careful co-doping as well as a judicious choice of the metal contacts to be employed.

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