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Anisotropic conductance at improper ferroelectric domain walls

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In ferroelectric oxides natural interfaces spontaneously arise in form of domain walls. Just like artificially constructed interfaces these domain walls are a rich source for fascinating physics resulting from their low symmetry, geometric confinement, electrostatics, and strain. Enhanced electronic transport properties are for instance reported to emerge at domain walls in various ferroelectrics such as $BaTiO_3$, $BiFeO_3$, $LiNbO_3$, or $Pb(Zr_{0.2}T_{i0.8})O_3$. In my talk I will demonstrate and discuss additional degrees of freedom that arise at domain walls in so-called improper ferroelectrics – systems in which the domain formation is determined by a primary order parameter other than the polarization. Due to the secondary nature of the polarization rather unusual domain wall configurations are stabilized leading to novel functionalities. Here, I will present two examples: Geometrically driven ferroelectric domain walls with anisotropic conductance properties and their magnetic analogue, i.e. hybrid domain walls in magnetically induced ferroelectrics. Results gained by cathode-lens microscopy, scanning-probe microscopy, and nonlinear optics will be shown providing insight to the domain wall physics on nano- to mesoscopic length scales.