What's so special about metal halide perovskites (HaPs)?

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We* scrutinized some of the apparent inconsistencies in these remarkable optoelectronic materials, such as high lifetimes *cum* modest mobilities, low temperature preparation *cum* low defect density, apparently flexible inorganic lattice *cum* very sharp diffraction peaks.[1] To start understanding these property combinations one first needs realize that *these materials should be compared much more with inorganic than with organic semiconductors* and that *concepts from OPV or DSS Cells are often inapplicable*. This is also reflected in the similarities that we find between $CsPbBr_3$ and $CH_3NH_3PbBr_3$.[2] In addition statements like they are "GaAs on the cheap", while true in some aspects, also cannot be defended as a general truth. An important factor is that electron-lattice coupling mechanisms are active at room temperature, and very likely dominate carrier scattering,[1] which connects to the materials' elasto-mechanical properties.[3] I hope also to present data from our experiments to test the idea of possible ferroelectric involvement in the remarkable low recombination rates (and, thus, high V_{OC}/E_G) in halide perovskites, to add to this partial view of what is (not)special about them.

* work is in collaboration with Prof. Gary Hodes

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Shorter version

We* scrutinized apparent inconsistencies in these remarkable optoelectronic materials, such as high lifetimes *cum* modest mobilities, low temperature preparation *cum* low defect density, apparently flexible inorganic lattice *cum* very sharp diffraction peaks. To understand these property combinations we need to realize that *HaPs should be compared more with inorganic than with organic semiconductors* and that *concepts from OPV or DSS Cells are often inapplicable*. This is also reflected in the similarities between $CsPbBr_3$ and $CH_3NH_3PbBr_3$. In addition they are not really "GaAs on the cheap" as electron-lattice coupling mechanisms are important and active at room temperature, and very likely dominate carrier scattering, which connects to the materials' elasto-mechanical properties. Data from our experiments to test the idea of possible ferroelectric involvement in the remarkable low recombination rates (and, thus, high V_{OC}/E_G) in halide perovskites, add to this partial view of what is (not)special about them.