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Overview of the low temperature cation local dynamics in (CH₃NH₃)PbI₃ perovskite

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(CH₃NH₃)PbI₃ hybrid perovskite has recently emerged again on the front of the scene because of its very good emissive properties which permit it to be used in new generation of high performance solar cells exhibiting efficiencies up to 22%. Electronic properties of this material are highly influenced by the local dynamics of cations. We will show how EFWS and IFWS scans recorded on IN16B can give unique and instructive overview of these dynamics in the 50-180 K temperature range. Moreover we will compare the results obtained on the fully hydrogenated compound and those obtained on the partially deuterated one (CD₃NH₃)PbI₃. In particular these measurements confirm rotational local motions of both CH₃ and NH₃ rotors in the orthorhombic phase exhibiting one energy of activation of 42-46 meV and relaxation times in the 1000 to 30 ps range. Importantly enough, beyond the transition temperature of 160K, while rotor dynamics are no more within the spectrometer resolution, the measurements on IN16B suggest emergence of a new slower dynamics which can be consistently related to measurements performed at higher temperatures on TOF IN5 spectrometer with a 100 μ eV energy resolution

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