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## Hybrid halide perovskite solar cells, disorder, and the dynamics of methyl ammonium ions

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Hybrid organic-inorganic solar cells based on hybrid organic-inorganic halide perovskite structures are promising candidates for cheap, solution processed, highly efficient (>20%) solar cells with a short energy payback time. The materials display many interesting behaviours such as high dielectric constants, ionic transport, photostriction, and hysteresis in the photovoltaic properties, some of which have been proposed to be related to the presence of the polar organic cation methylammonium. I will discuss quasielastic neutron scattering measurements showing that dipolar  $\text{CH}_3\text{NH}_3^+$  ions reorientate between the faces, corners or edges of the pseudo cubic lattice cages in  $\text{CH}_3\text{NH}_3\text{PbI}_3$  crystals with a room temperature residence time of around 14 ps. Free rotation,  $\pi$  flips and ionic diffusion are ruled out within a 1 - 200 ps time window. I will discuss the implications of these measurements, as well as structural and dynamic disorder in the crystals, for the properties and behaviour of perovskite semiconductor devices.

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