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Disentangling the roles of free-carrier density and mobility in the performance of $CH_3NH_3PbI_3$ perovskite films[1] ELBERT E.M. CHIA, CHAN LA-O-VORAKIAT[2], M.T. KHUC, R. HASELSBERGER, MARIA-ELISABETH MICHEL-BEYERLE, Division of Physics and Applied Physics, School of Physical and Mathematical Sciences, Nanyang Technological University, T. SALIM, HAIBIN SU, Y.M. LAM, School of Materials Science and Engineering, Nanyang Technological University, RUDOLPH A. MARCUS, Noyes Laboratory, California Institute of Technology — Apart from broadband absorption of solar radiation, the performance of photovoltaic devices is governed by two parameters carrier mobility and carrier density. They indicate how many and how fast the free carriers drift away from the light-harvesting medium before loss mechanisms, such as carrier recombination, occur. However, these parameters are usually entangled as a product. Using time-resolved terahertz spectroscopy, the number density, mobility and quantum yield of charge carriers in a perovskite film have been disentangled. The free carrier recombination mechanism and rates were determined, and hence the diffusion length. Our results suggest that perovskite-based solar cells can perform well even at low temperatures as long as the three-body recombination has not become predominant.

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