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Photo-Seebeck effect in methylammonium lead iodide thin films[1]

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— In recent years, the world has seen an increased dependence on renewable sources of energy. Among these, solar energy presents a growing field with many potential areas of research, including development of a viable active region in solar cells where light can be converted to electricity. Perhaps the most captivating emerging group of materials is the family of perovskites with structure ABX3, where A and B are cations and X is an anion. One potentially viable and efficient perovskite is methylammonium lead iodide (CH3NH3PbI3) or MAPbI3. While MAPbI3 is of great interest to researchers, some of its most fundamental transport properties have yet to be thoroughly studied. In this research, we measure the Seebeck coefficient of thin films of MAPbI3 as a function of conductivity for various light intensities and wavelengths. Seebeck data is very difficult to obtain without photoexcitation, and we utilize narrow-band high-power light emitting diode (LED) light sources spanning blue to infrared to populate the electronic conduction and valence bands. Our results are in rough agreement with accepted Boltzmann transport theory, and our modeling will help elucidate relationships between the concentration of free charge carriers, and their effective masses and scattering mechanisms.

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