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**Higher Performance of Photon-enhanced Thermionic Emission Energy Converter by Contact Ionization Rate Enhancement** HARUKI TAKAO, Osaka University, MARK CAPPELLI, Stanford University, TSUYOHITO ITO, Osaka University — Traditionally, thermionic energy conversion is most efficient at high temperatures ($> 1500$ K). In a recent study [J.W. Schwede et al., Nature Materials 9, 762 (2010)], photon-enhanced thermionic emission (PETE) from semiconducting cathodes was shown to drastically increases the thermionically-driven cathode current density at relatively low cathode temperatures (500-1100K). However, at the high emitted current densities (3 - 30 A/cm$^2$) electron transport will be space charge limited. Last year (Bulletin of the American Physical Society, 57 (2012)), we demonstrated that using a particle-in-cell (PIC) method, continuous laser excitation of the cesium resonance level in a PETE thermionic discharge with cesium filling (resonance-enhanced PETE, or R-PETE) can suppress the space charge and boost the output current, to near ideal limits. In this presentation, we analyze the converter efficiency with an improved PIC simulation. The results suggest that increasing the probability of contact ionization on the semiconducting cathode surface may be a means of realizing the high efficiency and high current densities that an R-PETE converter can offer.

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