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Feasibility Study of an EEDF Driven Rare Gas Metastable Laser[1]
GUY PARSEY, Michigan State University, YAMAN GÜÇLÜ, Max-Planck Institute, JOHN VERBONCOEUR, ANDREW CHRISTLIEB, Michigan State University — Following advancements in dipole-pumped alkali vapor lasers (DPAL), it has been shown that metastable excited rare gas atoms exhibit similar spectral properties with an inherently less reactive gain medium. Rare gas lasers (RGL) use an electric discharge to maintain the metastable species densities analogous to heating for the alkali vapor, both of which focus on optical pumping to induce lasing with a three-level scheme. We propose using a modified electron energy distribution function (EEDF) to either modify RGL efficiency characteristics or to drive the optical gain process. Using our general-purpose kinetic global modeling framework (KGMf), we present a study on the effect of the EEDF on the RGL reaction kinetics with an emphasis on determining if lasing can be achieved without optical pumping. Considering the classical optically driven RGL as a baseline, we focus on the EEDF as a pumping mechanism. A pure Ar model is used along with models of Ar, Kr, Xe using He to drive collisional relaxation of the upper level.

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