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Effects of Plasma Formation on the Cesium Diode (DPAL) and Excimer (XPAL) Pumped Alkali Laser[1] ARAM H. MARKOSYAN, MARK J. KUSHNER, University of Michigan — Diode pumped alkali lasers (DPALs) and excimer pumped alkali lasers (XPALs) are being investigated as a means to convert optical pumps having poor optical quality to laser radiation having high optical quality [1]. DPALs sustained in Cs vapor are pumped on the D_2(852.35 nm), $Cs(6^2S_{1/2}) \rightarrow Cs(6^2P_{3/2})$, transition and lase on the D_1(894.59 nm) transition, $Cs(6^2P_{1/2}) \rightarrow Cs(6^2S_{1/2})$. Collisional mixing (spin orbit relaxation) of the $Cs(6^2P_{3/2})$ and $Cs(6^2P_{1/2})$ levels is a key part of this three-level (in fact, a quasi-two-level) laser scheme. In the five-level XPAL pumping scheme, the $CsAr(B^2\Sigma^+_{1/2})$ state is optically pumped by 836.7 nm pulses, which later dissociates and produces $Cs(6^2P_{3/2})$. As in DPAL, a collisional relaxant transfers the population of $Cs(6^2P_{3/2})$ to $Cs(6^2P_{1/2})$, which enables lasing on D_1 transition. A first principals global computer model has been developed for both systems to investigate the effects of plasma formation on the laser performance. Argon is used as a buffer gas and nitrogen or ethane are used as a collisional relaxant at total pressure of 600 Torr at temperatures of 350-450 K, which produces vapor pressures of Cs of <0.1 Torr. In both systems, a plasma formation in excess of 10^{14} - 10^{16} cm^{-3} occurs, which potentially reduces laser output power by electron collisional mixing of upper and lower laser levels [2]. [1] W.F. Krupke, et. al., Opt. Lett. **28** 2336 (2003). [2] B.D. Barmashenko, et. al. Opt. Comm. **292**, 123 (2013).

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