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Indirect Auger recombination in nitride light emitters EMMANOUIL KIOUPAKIS, PATRICK RINKE, KRIS T. DELANEY, CHRIS G. VAN DE WALLE, Materials Department, University of California, Santa Barbara, CA 93106, USA — Nitride-based light emitters suffer from an efficiency loss at high drive currents (droop), which limits their high-power performance. The origin of this efficiency droop is not fully understood, and several loss mechanisms have been suggested as its cause. One such mechanism is Auger recombination, a three-carrier non-radiative recombination process that dominates over the radiative one at high carrier densities. We have employed first-principles computational techniques to show that Auger recombination is strong in nitride materials and therefore a likely cause of the droop in nitride LEDs. The underlying microscopic Auger recombination processes occur in an indirect way, mediated by electron-phonon and alloy scattering. Our work elucidates the origin of the droop and suggests ways to improve the high-power efficiency of nitride LEDs. This work was supported by the Center for Energy Efficient Materials, an Energy Frontier Research Center funded by the U.S. DOE, by the UCSB Solid State Lighting and Energy Center, and by the NSF MRSEC Program.

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