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Auger Recombination in monolayer WS2 PAUL CUNNINGHAM, KATHLEEN MCCREARY, BEREND JONKER, U.S. Naval Research Laboratory — Reduced dimensionality and strong Coulombic interactions are expected to enhance many-body interactions, like Auger recombination, in 2-D semiconductors. This may limit the performance of LEDs and Lasers based on monolayer transition metal dichalcogenides. We use ultrafast transient absorption spectroscopy to measure Auger recombination, e.g. exciton-exciton recombination, in CVD-grown monolayer WS2. We experimentally determine the Auger rate to be 0.089 cm^2/s at room temperature, which is an order of magnitude larger than the bulk value. This nonradiative pathway dominates for exciton densities larger than 10^11 cm^-2 and below the Mott density. Higher energy excitation above the A-exciton resonance produces a hot electron-hole gas that precedes exciton formation. Measurements in vacuum remove surface-bound oxygen that neutralizes n-type WS2 so that trions with a binding energy of 30 meV are observed, which decay on an ultrafast time scale.

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