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Superfluorescence from semiconductor quantum wells: magnetic field, temperature, and density dependence KANKAN CONG, Rice University, JI-HEE KIM, Sungkyunkwan University, G. TIMOTHY NOE II, Rice University, STEPHEN A. MCGILL, National High Magnetic Field Laboratory, Florida State University, YONGRUI WANG, ALEXEY A. BELYANIN, Texas A&M University, JUNICHIRO KONO, Rice University, STEPHEN A. MCGILL COLLABORATION, ALEXEY A. BELYANIN COLLABORATION — In the phenomenon of superfluorescence (SF), a macroscopic polarization spontaneously builds up from an initially incoherent ensemble of excited dipoles and then cooperatively decays, producing giant pulses of coherent radiation. SF arising from electron-hole recombination has recently been observed in semiconductor quantum wells, but its observability conditions have not been fully understood. Here, by fully mapping out the magnetic field (B), temperature (T), and pump power (P) dependence of SF intensity and linewidth, we have constructed a "phase' diagram, showing the B-T-P region in which SF is observable. In general, SF can be observed only at low enough temperatures, high enough magnetic fields, and high enough laser powers with characteristic threshold behaviors. For example, for the (11) inter-Landau-level transition, when $B = 17.5T$ and $P = 4mW$, SF can be observed only when $T < 105K$; at $B = 17.5T$ and $T = 4K$, SF can only be induced by excitation power $P > 0.05mW$. These results lay the foundation of our understanding of electron-hole SF and provide guidelines for our search for a Bardeen-Cooper-Schrieffer state of excitons.

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