Abstract Submitted
for the DAMOP19 Meeting of
The American Physical Society

Spatiotemporal profile of yoked superfluorescence from Rb vapor

KENTA KITANO, HARUKA MAEDA, Aoyama Gakuin University — Yoked superfluorescence (YSF) is a nonlinear optical phenomenon, which appears when a three level system is initially prepared in a superposition between the ground and the excited states. When the superfluorescence (SF) emission occurs between the excited and the intermediate states within the system decoherence time, it is accompanied by a simultaneous emission of a coherent pulse resulting from the transition from the intermediate to the ground states. The interplay between the two emissions is called YSF, which is considered as a time-delayed four-wave mixing process. We investigated the YSF of rubidium atoms by driving the 5S-5D two-photon transition with an ultrashort laser pulse. By increasing the pump-pulse power beyond the saturation intensity, the spatial profile of the YSF pulse resulting from the 6P-5S transition periodically changed between a central bright spot and a ring-shaped radial profile. The experimental results were successfully reproduced by simulations using the Maxwell-Bloch equations, indicating that a single-atom Rabi oscillation during the pump-pulse excitation is responsible for the spatial beam profile of the YSF pulse.

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Date submitted: 31 Jan 2019 Electronic form version 1.4