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Nonlinear Stability Analyses of Optical Pattern Formation in an Atomic Sodium Vapor Ring Cavity. DAVID WOLLKIND, Washington State University — The development of spontaneous stationary equilibrium patterns induced by the injection of a laser pump field into a purely absorptive two-level atomic sodium vapor ring cavity is investigated by means of various weakly nonlinear stability analyses applied to the appropriate governing evolution equation for this optical phenomenon. In the quasi-equilibrium limit for its atomic variables the mathematical system modeling that phenomenon can be reduced to a single modified Swift-Hohenberg nonlinear partial differential time-evolution equation describing the intracavity field on an unbounded two-dimensional spatial domain. Diffraction of radiation can induce transverse patterns consisting of stripes, squares, and hexagonal arrays of bright spots or honeycombs in an initially uniform plane wave configuration. Then these theoretical predictions are compared with both relevant experimental evidence and existing numerical simulations from some recent nonlinear optical pattern formation studies.

David Wollkind
Washington State University

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