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A Field-Theoretic Analysis Of A Cyclic Predator-Prey System (May-Leonard Model) SHANNON R SERRAO, UWE C TÄUBER, Department of Physics and Center for Soft Matter and Biological Physics, Virginia Tech — Spatially extended stochastic population dynamics models with cyclic predation interactions display intriguing time evolution and spontaneous structure formation. We study a general May-Leonard cyclic competition model in d dimensions with diffusive particle propagation. We use the second-quantized Doi-Peliti formalism and ensuing coherent-state path integral representation to construct its continuum representation and explore its collective dynamics. Expanding the resulting action about the mean-field species concentrations enables us to compute the diagonalized harmonic propagators and hence 'masses', i.e., relaxation rates and eigenfrequencies of the fundamental modes. Furthermore, operating near the Hopf bifurcation point, we identify the validity range for the necessary time scale separation that allows us to project out the purely relaxing eigenmode. The remaining oscillating fields obey the complex Ginzburg-Landau equation, which is consistent with spiral pattern formation.

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