Swift-Hohenberg equation with third order dispersion for optical fiber resonators

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We investigate the dynamics of a ring cavity made of photonic crystal fiber and driven by a coherent beam working near to the resonant frequency of the cavity. By means of a multiple-scale reduction of the Lugiato-Lefever equation with high order dispersion, we show that the dynamics of this optical device, when operating close to the critical point associated with bistability, is captured by a real order parameter equation in the form of a generalized Swift-Hohenberg equation. A Swift-Hohenberg equation has been derived for several areas of nonlinear science such as chemistry, biology, ecology, optics, and laser physics. However, the peculiarity of the obtained generalized Swift-Hohenberg equation for photonic crystal fiber resonators is that it possesses a third-order dispersion. Based on a weakly nonlinear analysis in the vicinity of the modulational instability threshold, we characterize the motion of dissipative structures by estimating their propagation speed. Finally, we numerically investigate the formation of moving temporal localized structures often called cavity solitons.