The universal law of the front speed close to the disappearance of bistability

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Abstract

Multistable systems present rich dynamical behaviors of interfaces between the different equilibria [1]. Close to the disappearance of bistability, i.e., transition between a bistable to a monostable region, we show that the speed of fronts follows a square root law as a function of the bifurcation parameter. Analytically and numerically, we show this law for different prototype models of bistable systems. Based on a liquid crystal light valve experiment with optical feedback [2], we investigate the front speed close to the disappearance of bistability. Our results apply both to systems that do or do not follow energy minimization principles [3]. Experimental findings show a quite fair agreement with the theoretical results.

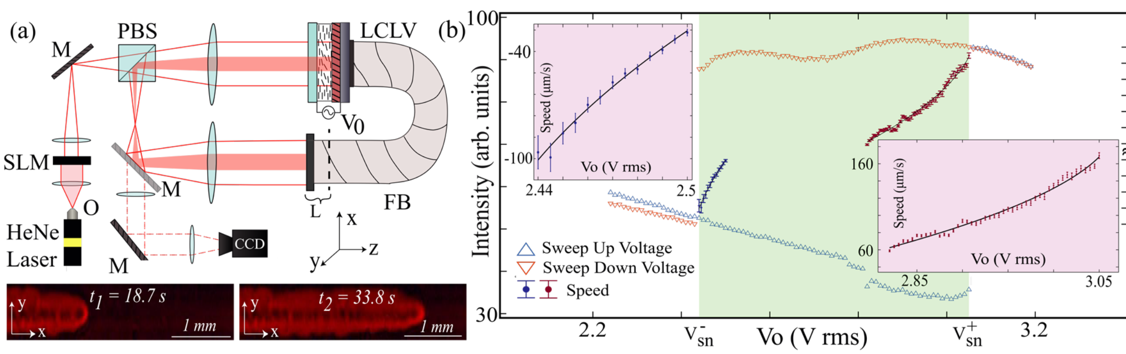

Figure 1: (a) Schematic representation of LCLV with optical feedback setup. Lower panels show temporal snapshots sequence of the front propagation exhibited in the LCLV close to the disappearance of bistability. (b) Bifurcation diagram of the total intensity and front speed of the LCLV with optical feedback as a function of the voltage applied V_0 by $L = 0.0\ cm$. The continuous curves are the fits found for the front speeds, which have the form $v = v_0 + \alpha\sqrt{|\epsilon - \epsilon_0|}$, where {$R^2 =$ 0,9469; $\alpha = 475.6\ (\mu m/s) / \sqrt{Vrms}$; $\epsilon_0 = 2.41\ Vrms$; $v_0 = 21\ \mu m/s$} and {$R^2 =$ 0,9878; $\alpha = -292.3\ (\mu m/s) / \sqrt{Vrms}$; $\epsilon_0 = 3.069\ Vrms$; $v_0 = 208.3\ \mu m/s$}, for the left and right fit, respectively.

Acknowledgment: This work was funded by ANID-Millennium Science Initiative Program-ICN17 012 and Fondecyt project 1180903.

References

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