Why gradient flows of some energies good for defect equilibria are not good for dynamics, and an improvement

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• An augmented Oseen-Frank energy density is introduced with additional symmetries to deal with non-singular defects in NLC.

• The gradient flow dynamics of this energy is capable of recovering defect equilibria but it cannot deal with the physically expected dynamic behaviors.

• A dynamic model is introduced based on defect kinematics and thermodynamics. With this model, we explain the reasons why the gradient flow fails and an improvement is given.

• Various problems of slow defect dynamics are solved with this model, indicating its capability.