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Cooking skyrmions: modeling temperature dependence of defect textures in cholesteric liquid crystals[1] SAJEDEH AFGHAH, ANDREW KONYA, JONATHAN SELINGER, ROBIN SELINGER, Liquid Crystal Institute, Kent State University — Using 3-d simulations and analytical calculations, we study temperature dependence of defect structures in liquid crystals in confined geometries. We model a cholesteric liquid crystal confined in a microchannel with homeotropic anchoring, and investigate resulting defect structures—skyrmions, alone or in periodic arrays (bubble domains), and striped textures —as a function of microchannel dimensions, cholesteric pitch, and surface anchoring strength. We model temperature dependence by varying Frank constants and pitch using functions fit to experimental values. Experiments by the Qihuo Wei group show that skyrmion arrays in a microchannel appear to "pop" at a threshold temperature, transforming into elongated defects that span the microchannel's width. We explore this behavior using simulation and show that skyrmions elongate when their spacing is below a critical distance. Implementation of the simulation code in CUDA for a GPU-equipped computer produces highly efficient performance. We also carry out analytical calculations of free energy to determine optimal/stable structures for skyrmions and other defect textures in thin cells. Both simulation and analytical results are compared to recent experiments by the Qihuo Wei group.

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