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Melting of vortex crystals in a minimal model for active fluids MARTIN JAMES, Max Planck Institute for Dynamics and Self-Organization, Goettingen, Germany, DOMINIK ANTON SUCHLA, Faculty of Physics, University of Goettingen, Goettingen, Germany, JORN DUNKEL, Department of Mathematics, Massachusetts Institute of Technology, Cambridge, Massachusetts, USA, MICHAEL WILCZEK, Max Planck Institute for Dynamics and Self-Organization, Goettingen, Germany — Two-dimensional crystals show several intriguing properties. For instance, crystals in equilibrium systems lack long-range positional order and their melting is a complex phenomenon. Here we investigate the formation and melting of a nonequilibrium crystal, an active vortex crystal, in a minimum continuum model for active matter. Using simulations, we find spontaneously emerging vortex crystal solutions after an extended turbulent transient. These active vortex crystals melt into a turbulent active fluid as the activity or the advection, the two free parameters in the model, are changed. We map out the phase diagram and systematically characterize the melting transition as a function of both the parameters. Depending on the path through the parameter space, the melting exhibits diverse transition scenarios; it may proceed through a hysteretic marginal stability region or an intermediate hexatic phase. Our results indicate that crystalline phases in active matter share similarities with their equilibrium counterparts.

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