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Energetic stability of coreless vortices in spin-1 Bose-Einstein condensates with conserved magnetization[1] MAGNUS BORGH, JUSTIN LOVEGROVE, JANNE RUOSTEKOSKI, University of Southampton — We show that a coreless vortex can be energetically stable when phase-imprinted on a spinor Bose-Einstein condensate whose interactions favor the polar phase [1], as prepared in recent experiments. Coreless vortices would in this case not be expected to occur by simple energetic arguments alone. The stabilizing mechanism instead arises from conservation of the prepared longitudinal magnetization, which causes mixing of phases. The stable vortex can then form a composite topological defect with distinct small- and large-distance topology: a hierachical core structure forms where an inner ferromagnetic coreless vortex continuously deforms toward an outer singular, singly quantized polar vortex. A similar mechanism can also stabilize a nonsingular nematic texture—a nematic coreless vortex—in the polar phase as the inner core of an outer ferromagnetic singular vortex. We describe the composite core by constructing a qualitative analytic model. Our results suggest that spinor condensates may act as laboratory emulators to shed light on the generic features of composite cores that appear also in, e.g., superfluid ^{3}He and high-energy physics.

[1] J. Lovegrove, M. O. Borgh and J. Ruostekoski, Phys. Rev. Lett., in press, arXiv:1306.4700.

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Magnus Borgh
University of Southampton

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