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Fingering instabilities in a two-component dipolar Bose-Einstein condensate[1] KUI-TIAN XI, Zhejiang University, TIM BYRNES, New York University Shanghai, HIROKI SAITO, The University of Electro-Communications — We study fingering instabilities and pattern formation at the interface of an oppositely polarized two-component Bose-Einstein condensate (BEC) with strong dipole-dipole interactions (DDIs) in three dimensions. It is shown that the rotational symmetry is spontaneously broken by fingering instabilities when the DDIs are strengthened. Frog-shaped and mushroom-shaped patterns have been shown with different strengths of the DDIs. A Bogoliubov analysis gives a qualitative understanding of the interfacial instabilities of the two dipolar BECs, and a dispersion relation similar to that in classical fluids is obtained. Spontaneous density modulation and dipolar domain growth in the dynamics have also been demonstrated, in which we have analyzed the characteristic sizes of the dipolar domains corresponding to different patterns at the initial and later times in the evolution. We have also investigated the parameter dependence of the ground states, and found that the droplet patterns are formed due to the population imbalance in the two components. Labyrinthine patterns grow as the trap ratio increases, and a striped phase appears as the angle of tilted polarization increases. Our findings may establish further connections between superfluids and classical fluids.

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