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Induced interaction and crystallization of impurity fields in a Bose-Einstein condensate DAVID ROBERTS, Los Alamos National Laboratory, SERGIO RICA, LPS, Ecole Normale Superieure — We model the behavior of N impurity classical fields immersed in a larger Bose-Einstein condensate by N+1 coupled nonlinear Schrodinger equations in 1, 2, and 3 dimensions. We discuss the stability of the uniform miscible system and show the importance of surface tension for self-localization of the impurities. We derive analytically the behavior of the attractive tail of impurity-impurity interaction due to the mediating effect of the underlying condensate. Assuming all impurities interact with the same strength, we numerically explore the phase diagram which contains four phases, namely i) where all fields are miscible; ii) where the impurities are miscible with each other but phase separate from the condensate as a single bubble; iii) where the impurities phase separate from the condensate and form a crystalline structure within a bubble; and iv) where localized impurities stay miscible within the condensate. Finally, we argue that the crystalline phases maintain a nonclassical rotational inertia, and hence have properties reminiscent of a supersolid.

David Roberts
Los Alamos National Laboratory

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