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Generic Phase Diagram for Bose-Einstein Condensation of Weakly Interacting Symmetric Bosonic Mixtures A.B. KUKLOV, CSI, CUNY, T. BLANCHARD, ENS, Cachan, France, B.V. SVISTUNOV, UMASS, Amherst, USA, and Kurchatov Institute, Russia — Weakly interacting Bose gas represents *strongly* correlated classical field within a domain (determined by the gas parameter) of its Bose-Einstein condensation (BEC) temperature $T = T_c$. Thus, N-component *weakly* interacting mixtures representing some symmetry can potentially exhibit rich phase diagram (PD). In particular, it can feature *quasi-molecular* phases preceding actual formation of the ODLRO in the vicinity of T_c. However, realization of a specific part of the PD depends on details of interactions. As examples, we consider mixtures characterized by O(2)×O(2) symmetry ($N = 2$) and spin $S = 1$ with the symmetry reduced to U(1)×U(1) ($N = 3$). Monte Carlo simulations of these systems find a *single* line of the respective two- and three-component BEC transitions which has tricritical point separating II and I order transitions. No *quasi-molecular* phases have been found despite that naïve mean field (with one loop correction) predicts it. We discuss how such phases can emerge above the actual N-component BEC transition. One suggestion relies on Feschbach resonance detuned into negative inter-specie scattering length even when the gas parameter remains small. We acknowledge support from NSF grants PHY 0653135, 0653183 and CUNY grant 80209-0914.

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