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Ground state properties of mixtures of condensates

I will present a rigorous proof of the ground state energy asymptotics for multi-component condensates. Such systems consist of multiple species of identical bosons, and their mathematical study has become topical very recently.

I will show that, both in the mean field and Gross-Pitaevskii regime, the leading order of the ground state energy is captured by the minimum of a suitable one-body non-linear functional. Moreover, the ground state exhibits condensation in the sense of reduced density matrices.

In the mean field regime, by an implementation of Bogoliubov theory, we are also able to compute the next-to-leading order of the ground state energy asymptotics, and to prove a norm approximation for the ground state.

All our results hold under a miscibility condition, as is often called in physics literature, that allows us to prove uniqueness of the minimizer of the non-linear theory.

This is a joint work with Alessandro Michelangeli and Phan Thành Nam.