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Self-consistent theories of many-body dynamics

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The quasi-free reduction of the non-relativisitic many-body dynamics leads to two fundamental systems - the Bogolubov-de Gennes (BdG) and Hartree-Fock-Bogolubov (HFB) equations. The first one describes fermions and is equivalent to the Bardeen-Cooper-Schriefer theory of superconductivity. The second gives an account of bosons and is used to describe the Bose-Einstein condensation In this talk, I will explain how the quasi-free reduction works and describe some recent results on the BdG and HFB equations. In particular, focusing on the Bogolubov-de Gennes equations, I will describe the key physical classes of stationary solutions (normal, superconducting, vortex and vortex lattice states) and recent results on their existence and stability.

The talk is based on joint work with Li Chen and with V. Bach, S. Breteaux, Th. Chen and J. Fröhlich.

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