SOLVABILITY OF BEC/BCS CROSSOVER HAMILTONIANS

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In the last several decades a prolific field of research has flourished, dedicated to constructing and analysing exactly solvable quantum models. The understanding of quantum integrability that made such analysis tractable finds its origin in the melding of the Quantum Inverse Scattering Method and Bethe Ansatz techniques. This approach can be complicated and difficult to implement. In some instances an ability to extend the exact solutions to the most general Hamiltonians to which they are applicable is outside the scope of such techniques. In this presentation, I will highlight results of a recent paper demonstrating an alternative method, that enables such a determination. Remarkably this determination does not rely on any prior knowledge of integrability through the existence of a set of conserved operators. In particular, we derive the solvability conditions for a general family of Hamiltonians describing the crossover between the low-temperature phenomena of superconductivity, in the Bardeen-Cooper-Schrieffer theory, and Bose-Einstein condensation. We then determine the manifolds in the coupling parameter space for which these Hamiltonians can be solved exactly.