EXACTLY SOLVABLE BCS PAIRING HAMILTONIANS

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The Bardeen-Cooper-Schrieffer (BCS) theory of superconductivity proposed in 1957, based on the notion of Cooper pairs, is one of the most celebrated achievements of quantum physics. The first work on the exact solution of a BCS pairing Hamiltonian, in the sense of a Bethe ansatz, was developed by Richardson in 1963. These results remained largely unknown until experimental developments on metallic nanograins occurred in the 1990s, at which point the exact solution was utilised to reconcile apparent discrepancies between theory and experiment. Since then there have been substantial efforts dedicated to the analysis of BCS pairing Hamiltonians using exact methods. In this talk I will provide an overview of recent progress on this topic. I will highlight the role of the algebraic structures which underpin the approach of the Quantum Inverse Scattering Method, and algebraic Bethe ansatz, for the derivation of exactly solvable BCS models. I will also discuss what we have learnt, and can hope to further discover, from these exact solutions about the physical properties of the models.