Richardson-Gaudin models: What can we learn from (breaking) symmetry?

Richardson-Gaudin integrable models are special players within the general framework of many-body systems. While their underlying algebraic structure allows for an exact solution by Bethe Ansatz, the large freedom left in their construction makes them effective models for an extensive range of physical phenomena such as superconductivity and quantum magnetism.

In this talk, I will focus on the class of hyperbolic Richardson-Gaudin models. After a general introduction to these models, it will be shown how these symmetries can be exploited in order to write down expressions for physical observables as determinants of matrices. Furthermore, by breaking the u(1) symmetry of these models, the subtle interplay between different symmetry sectors can be uncovered, shedding some light on the structure of the (Bethe Ansatz) wave functions. Throughout this talk, the general theory will be illustrated with a specific model related to topological superconductivity, highlighting the physical consequences of these results.

The talk will mainly be based on these two papers:

[1] P. W. Claeys, S. De Baerdemacker, M. Van Raemdonck, and D. Van Neck, Phys. Rev. B 91, 155102 (2015). arxiv:1501.05827
[2] P. W. Claeys, S. De Baerdemacker, and D. Van Neck, Phys. Rev. B 93, 220503(R) (2016). arxiv:1601.03990