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Impurities in Bose gasses - recent results on a newly proposed model

In the recent papers ([1]-[4]), the authors investigate a new model describing an impurity in a dilute Bose gas. Compared to the older Frölich model, this new model not only predicts experimental observations better (see [2]), it also has three-particle interactions which are important to model Efimov type physics (see [1],[4]). The aim of this talk is to introduce this new model and present some rigorously proven results which are used in the papers. In particular the authors of the paper [1] used that the global minimum for the mass shell is obtained at total momentum 0 in order to perform variational calculations. We prove this and other results as corollary of a general theorem on positivity improving semigroups which extends results found in the literature.

References

[1] Impurity in a Bose-Einstein Condensate and the Efimov Effect. J. Levinsen, M. M. Parish, and G. M. Bruun. PRL 115, 125302 (2015).

[2] Observation of Attractive and Repulsive Polarons in a Bose-Einstein Condensate. N. B. Jørgensen, L. Wacker, K. T. Skalmstang, M. M. Parish, J. Levinsen, R. S. Christensen, G. M. Bruun, and J. J. Arlt. PRL 117, 055302 (2016).

[3] Strong-coupling Bose polarons in a Bose-Einstein condensate. F. Grusdt, R. Schmidt, Y. E. Shchadilova, and E. Demler. PHYSICAL REVIEW A 96, 013607 (2017).

[4] Quantum dynamics of ultracold Bose polarons. Y. E. Shchadilova, R. Schmidt, F. Grusdt and E. Demler. PRL 117, 113002 (2016).