Scientific report on the visit to Drs. J. Levinsen and M. Parish

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Scientific Report on the project "The fate of Efimov trimers when squeezed from three to two dimensions" Cambridge (UK), 5th-7th of December 2012

The visit to Drs. Levinsen and Parish at the *Theoretical Condensed Matter* (TCM) department of the University of Cambridge has been a particularly fruitful one. The aim of the visit was discussing the status of our common project on three-body bound states and recombination in a bosonic gas under strong transverse confinement. During the three days of my stay, we have been reviewing the experimental news from the experimental group of Prof. R. Grimm in Innsbruck, with whom we are collaborating. The most recent laboratory data on three-body recombination (the key physical observable in this problem) are in impressive agreement with an improved version of our theoretical model, giving us confidence that our equations contain and accurately describe the physics at play in the Innsbruck experiment. The theoretical model is now at a very advanced stage of completion, but conclusive numerical simulations are still needed to get a complete picture of the effect under examination.

On the side, we are extending our model to the case of distinguishable particles with different masses, where the effects of Efimov physics should be much easier to see, due to a more favorable scaling. This extension is particularly relevant in view of the observation of Feshbach resonances in a Cesium-Lithium mixture, reported last month in arXiv preprints 1211.2139 and 1211.2888. We have collected a comprehensive set of notes on this topic, and the actual writing of the paper will soon start.

Prospected scientific output and future extensions

We expect that the present work will lead to a joint theoretical/experimental paper with the Innsbruck group, which will be targeted to a high-impact journal.

We plan moreover to write a purely theoretical, more comprehensive paper which will contain the fine details of the model, and its extensions to the mass-imbalanced case.

Further collaborations with Drs. Levinsen and Parish are surely envisaged, on topics ranging from few-body physics (along the lines of the present project) to many-body physics (such as studying SU(N) magnetism in synthetic gauge fields).