3-body Borromean effects in a frozen Rydberg gas

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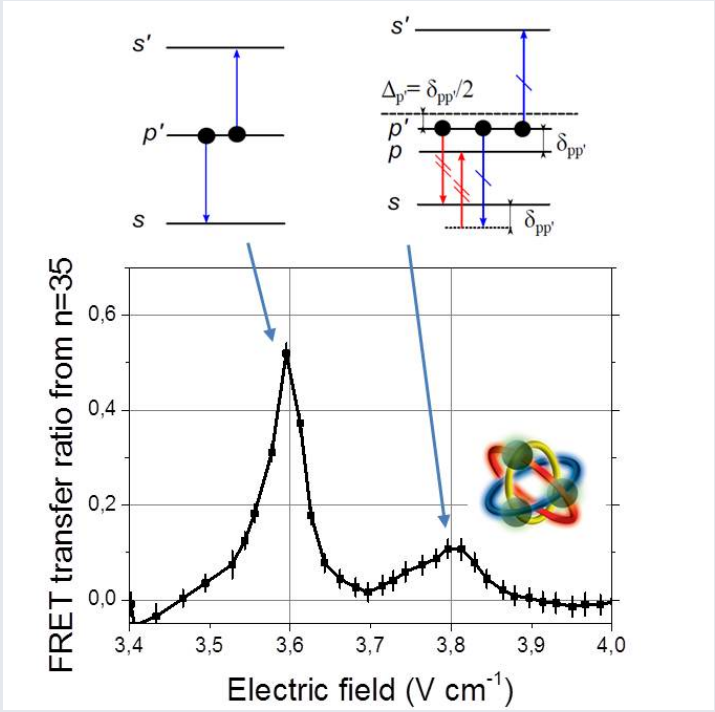
We have observed resonant energy transfer effects involving at least 3 atoms in a cold gas of cesium Rydberg atoms under dipole-dipole interactions and at a temperature of T ~ 100 μK [Faoro2015]. This effect can take place while no 2-atom energy exchange is present and is therefore named Borromean in reference to the three Borromean rings held together while no bond links them two-by-two. This effect should be generalizable to other atomic systems or perhaps molecules and might be used to perform quantum computation or simulation.



On the right: three rings connected with Borromean coupling. The solid black curve presents the population transfer ratio from the initial 35p Rydberg state to the 35s and 36s Rydberg states of cesium. The largest peak on the left corresponds to the 2-body Förster resonance at 3.6 V/cm while the second peak at 3.8 V/cm corresponds to the 3-body resonance. The level schemes display the corresponding non-radiative energy exchanges.

I. Mourachko, D. Comparat, F . de Tomasi, A. Fioretti, P. Nosbaum, V. Akulin, P. Pillet, *Many-body effects in a frozen Rydberg gas,* Phys. Rev. Lett. 80, 253-256 (1998)

R. Faoro, B. Pelle, A. Zuliani, P. Cheinet, E. Arimondo, P.Pillet, *Borromean three-body FRET in frozen Rydberg gases*, Nature Communications 6, 8173 (2015)

Results obtained in the framework of the project CYRAQS funded by topic 1 of LabEx PALM and carried out Patrick Cheinet (LAC) and David Clement (LCF).