

# **Winter school on Physics with Trapped Charged Particles**

## **Report of Abstracts**

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# Electronic coupling between two ions stored in different traps

## Content

The coupling of ions stored in different traps through the charges they induce in a common electrode was proposed in Ref. [1], but it has not been accomplished yet. The completion of such a system would be an outstanding technological breakthrough in quantum electronics and would pave the way for the implementation of hybrids systems for quantum information [2]. A pioneer work using radio-frequency traps started at the UC Berkeley several years ago (see e.g. [3]). With the same technical objective, but now using 7-T Penning traps we started to build the TRAPSENSOR facility at the University of Granada in 2012.

The first scientific aim envisaged is to perform high precision mass spectroscopy utilizing a single, laser cooled, calcium ion as a sensor [4,5]. This will overcome the tradeoffs among precision, number of ions used in the measurement and sensitivity to the target-ion's mass-to-charge ratio existing in current techniques.

To achieve this, the first outstanding goal is to measure the energy transfer between Doppler-cooled ions ( $\langle n \rangle \sim 1000$  phonons) stored in different traps [6].

In this contribution we will present the full facility, report on the status of this singular experiment, and present the results obtained in two ion-trapping platforms. The ongoing work with prospects to reach the single energy quanta exchange level ( $\langle n \rangle = 0$ ) will be also outlined.

[1] D.J. Heinzen and D.J. Wineland, Phys. Rev. A **42**, 2977 (1990).

S. Kotler et al., Phys. Rev. A **95**, 022327 (2017).

N. Daniilidis et al., J. Phys. B **42**, 144012 (2009).

D.Rodriguez, Appl. Phys.B: Lasers O. **107**, 1031 (2012).

F. Dominguez et al., Sci.-Rep. **7**, 8336 (2017).

J.M. Cornejo et al., Int. J. Mass Spectrom. **410**, 22 (2016).

## Summary

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