Heating-rate measurements in micro-fabricated surface traps containing Sr^+ ions

B. Szymanski[1], J.-P. Likforman[1], S. Guibal[1], C. Manquest[1], L. Guidoni[1], and M. Woytasik[2]

[1] *Univ Paris Diderot, Sorbonne Paris Cité, Laboratoire Matériaux et Phénomènes Quantiques,, UMR 7162, Bat. Condorcet, 75205 Paris Cedex 13, France*

[2] *Institut d'Électronique Fondamentale, UMR CNRS 8622, Université Paris Sud,, Centre Scientifique d'Orsay, France*

Presenting Author: luca.guidoni@univ-paris-diderot.fr

We designed, realized and operated a micro-fabricated ion surface trap [1] with Copper electroplated electrodes on a silica substrate. We load the trap with single $^{88}Sr^+$ ions that are Doppler cooled by addressing the $5s\ ^2S_{1/2} \rightarrow 5p\ ^2P_{1/2}$ transition ($\nu = 711$ THz, $\lambda = 422$ nm) using two different strategies in order to avoid the accumulation of the population into the metastable $4d\ ^2D_{3/2}$ state during the cooling process (see figure 1). In a first (quite usual) case we drive the $4d\ ^2D_{3/2} \rightarrow 5p\ ^2P_{1/2}$ 275 THz transition with a "repumping" laser . In a second case we drive both the $4d\ ^2D_{3/2} \rightarrow 5p\ ^2P_{3/2}$ (299 THz) and $4d\ ^2D_{5/2} \rightarrow 5p\ ^2P_{3/2}$ (290 THz) transitions in order to avoid coherent population trapping phenomena that originate in the previous Λ scheme [2]. We characterize the heating-rate of the trap by applying the Doppler re-cooling method that has been first developed and applied in the case of ions that do not have metastable states [3]. We analyze and compare the Doppler re-cooling experimental results obtained with the same trap and under identical conditions but using these two different "repumping" strategies.

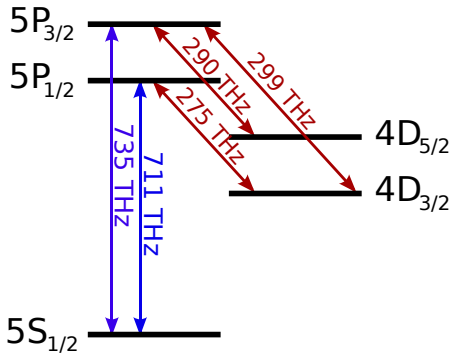

Figure 1: *Low energy levels scheme for Sr^+.*

References

[1] S. Seidelin *et al.* Phys. Rev. Lett. **96**, 253003 (2006)
[2] D. T. C. Allcock *et al.* New J. Phys. **12**, 053026 (2010)
[3] J. H. Wesenberg *et al.* Phys. Rev. A **76**, 053416 (2007); R. J. Epstein *et al.* Phys. Rev. A **76**, 033411 (2007)