Atom-Chip for Quantum Control

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We implemented a versatile set-up where bi-chromatic radiation in a Raman configuration can be shined onto a Bose-Einstein condensate produced in an Atom-Chip. The Atom-Chip is also equipped with RF sources for coherent transfer of atoms between internal states in order to realize an atom interferometer capable of fully characterizing the atomic state. We demonstrated a completely new scheme for the tomographic reconstruction of atomic states that combines the inherent stability of the atom chip setup with the flexibility of optimization schemes. This scheme allowed confirming of the superb control on parameters allowed by the experimental set-up and put it to use on improved control algorithms to realise arbitrary superposition states. With our Atom-Chip, we were also able to demonstrate, for the first time, Quantum Zeno dynamics.

References

[1] C. Lovecchio, S.Cherukattil, B.Cilenti, I.Herrera, F.S.Cataliotti, S.Montenegro, T.Calarco, F.Caruso arXiv:1504.01963 [quant-ph] 8 Apr 2015