Towards Coherent Matter Wave Optics on Atom–Chips

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Magnetic traps are a widely used tool to trap and manipulate neutral atoms. Implementing the necessary current carrying structures on a microfabricated atom–chip leads to a great versatility.

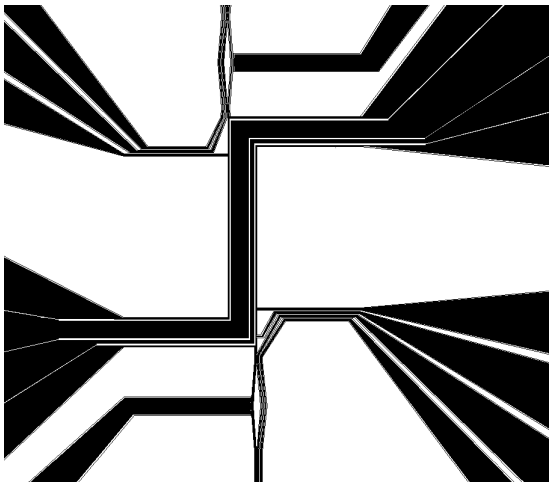

Figure 1: Example of an atom–chip with two interferometers on it.

This technique enables us to tailor magnetic potentials for different purposes, e. g. atom guides and beamsplitters. The principles of magnetic traps will be discussed and examples for atomic waveguides will be presented. Also, some magnetic potentials to split and recombine an atomic cloud will be shown.

For the success of the concept of an atom–chip it will be of great importance to be able to manipulate the atomic waves coherently. The principles of one interferometer design which will test for coherent splitting and guiding will be presented. As opposed to other proposals our interferometer does not rely on a single mode matter wave source (BEC). In idealized model calculations [1], high contrast fringes were observable for a thermal, i. e. multi mode source. Deviations from this model will also be discussed.

[1] E. Andersson, *Phys. Rev. Lett.* **88** 100401 (2002).