Towards the Detection of Momentum Entangled Atom Pairs
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Vienna / University of Vienna — We present our work towards the creation and de-
tection of momentum entangled states of metastable helium (He*) atoms. Starting
from a Bose-Einstein condensate (BEC) of metastable helium, stimulated Raman
transitions transfer momentum onto the atoms. Subsequent collisions between two
counterpropagating matter waves lead to atom pairs that are entangled in their mo-
mentum degree of freedom. This state represents a three-dimensional version of the
one discussed in the Einstein-Podolsky-Rosen gedankenexperiment. By using a po-

tion resolved micro-channel plate (MCP) detector the high internal energy of the
He* atoms of almost 20 eV per atom allows for efficient detection of individual atoms
with a high spatial and temporal resolution. We show that a double double-slit as
well as a ghost interference scheme can be used to show the entanglement and that
those schemes are feasible with experimental restrictions in our setup. We discuss
the main challenges in the experimental realization and present the present status
of the experiment.

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Date submitted: 15 Nov 2013
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