Transverse Focusing Effects in the Zeeman Deceleration of Hydrogen Atoms

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Zeeman deceleration is an experimental technique in which inhomogeneous, time-dependent magnetic fields inside an array of solenoid coils are used to manipulate the velocity of a supersonic beam [1, 2]. We have built and characterised a 12-stage Zeeman decelerator for hydrogen atoms in Oxford. We will present experimental results illustrating that the overall acceptance in a Zeeman decelerator can be significantly increased by applying a low, anti-parallel magnetic field to one of the coils so as to form a temporally varying quadrupole field which improves transverse particle confinement [3]. The results show excellent agreement with three-dimensional numerical particle trajectory simulations, and they suggest the use of a modified coil configuration to improve transverse focusing during the deceleration process.
We will also report on current work which is directed towards the magnetic deceleration of metastable species using a pulsed electron gun system.

References

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