

5. Conclusion

We used phase choppers to measure the velocity of atoms in an atom interferometer with 0.1% uncertainty. Phase choppers work for continuous or pulsed beams, do not require resolved diffraction, have no moving parts, and work well for many types of atoms and molecules. These velocity measurements enable high-precision absolute and ratio measurements of atomic polarizabilities. This work was supported by NSF Award no. 0969348.

References

- [1] Holmgren W F, Revelle M C, Lonij V P A and Cronin A D 2010 Absolute and ratio measurements of the polarizability of Na, K, and Rb with an atom interferometer *Phys. Rev. A* **81** 053607
- [2] Berninger M, Stefanov A, Deachapunya S and Arndt M 2007 Polarizability measurements of a molecule via a near-field matter-wave interferometer *Phys. Rev. A* **76** 013607
- [3] Miffre A, Jacquy M, Büchner M, Trenec G and Vigué J 2006 Measurement of the electric polarizability of lithium by atom interferometry *Phys. Rev. A* **73** 011603
- [4] Ekstrom C R, Schmiedmayer J, Chapman M S, Hammond T D and Pritchard D E 1995 Measurement of the electric polarizability of sodium with an atom interferometer *Phys. Rev. A* **51** 3883–8
- [5] Lenef A, Hammond T D, Smith E T, Chapman M S, Rubenstein R A and Pritchard D E 1997 Rotation sensing with an atom interferometer *Phys. Rev. Lett.* **78** 760–3
- [6] Gustavson T L, Bouyer P and Kasevich M A 1997 Precision rotation measurements with an atom interferometer gyroscope *Phys. Rev. Lett.* **78** 2046–9
- [7] van den Meijdenberg C J N 1988 *Atomic and Molecular Beam Methods* vol 1, ed G Scoles (Oxford: Oxford University Press)
- [8] Tikhonov G, Wong K, Kasperovich V and Kresin V V 2002 Velocity distribution measurement and two-wire field effects for electric deflection of a neutral supersonic cluster beam *Rev. Sci. Instrum.* **73** 1204–11
- [9] Brezger B, Hackermüller L, Uttenthaler S, Petschinka J, Arndt M and Zeilinger A 2002 Matter-wave interferometer for large molecules *Phys. Rev. Lett.* **88** 100404
- [10] Christen W, Krause T, Kobin B and Rademann K 2011 Precision velocity measurements of pulsed supersonic jets *J. Phys. Chem. A* **115** 6997–7004
- [11] Roberts T D, Cronin A D, Tiberg M V and Pritchard D E 2004 Dispersion compensation for atom interferometry *Phys. Rev. Lett.* **92** 060405
- [12] Roberts T D 2002 Measuring atomic properties with an atom interferometer *PhD Thesis* Massachusetts Institute of Technology
- [13] Cronin A D, Schmiedmayer J and Pritchard D E 2009 Optics and interferometry with atoms and molecules *Rev. Mod. Phys.* **81** 1051
- [14] Berman P (ed) 1997 *Atom Interferometry* (San Diego, CA: Academic)
- [15] Tarnovsky V, Bunimovicz M, Vučković L, Stumpf B and Bederson B 1993 Measurements of the dc electric dipole polarizabilities of the alkali dimer molecules, homonuclear and heteronuclear *J. Chem. Phys.* **98** 3894