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Atom beam velocity measurements using phase choppers

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Abstract. We describe a new method to measure atom beam velocity in an atom interferometer using phase choppers. Phase choppers are analogous to mechanical chopping discs, but rather than being transmitted or blocked by mechanical choppers, an atom receives different differential phase shifts (e.g. zero or π radians) from phase choppers. Phase choppers yield 0.1% uncertainty measurements of beam velocity in our interferometer with 20 min of data and enable new measurements of polarizability with unprecedented precision.

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1. Introduction

More accurate methods for measuring atomic velocity are needed to support high-precision atom interferometry experiments. For example, atom beam velocity is the leading source of uncertainty in several measurements of atomic and molecular polarizabilities [1–4]. This is