Optical cavities in atom interferometry

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Optical cavities provide power enhancement and spatial filtering of laser beams, as well as a predictable and well-defined beam geometry, features that help with the main drawbacks of large-momentum-transfer atom interferometers. However, performing the interferometric sequence inside an optical cavity presents unique challenges. We find that, for the short pulses needed for multi-photon Bragg diffraction, there is a limit to the cavity bandwidth beyond which the cavity actually degrades the pulse. Furthermore, the requirement of sustaining a large-sized beam imposed by the atom interferometer works against both the quality of the cavity as a spatial filter and its geometrical stability. These limitations place constraints on the versatility of certain cavity configurations. An alternative cavity configuration based on four mirrors in a "beam expander" configuration can help overcome the limitations on beam size of the two-mirror design whilst maintaining a stable configuration and providing enhanced spatial filtering.

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