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Considerations for a dual accelerometer/gyroscope using continuous opposing atomic beams

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We report on studies completed in the design of a dual atom beam accelerometer/ gyroscope. As demonstrated in [1,2], two opposing beam atom interferometers can distinguish between linear and rotational motion. Our design uses the transit time of slow moving atoms that originate from a 2D MOT through continuous Raman laser fields as the 'pulse' of light' for light pulse interferometry. Using both Monte Carlo methods as well as analytic expressions, we explore the effects of longitudinal and transverse velocity spread, laser beam profile and scattered light on the contrast of the interference fringe. We present the status of the construction of our prototype (Fig. 1). We present measurements of narrow velocity profiles from our source and demonstrate Raman spectroscopy using a cold continuous source.

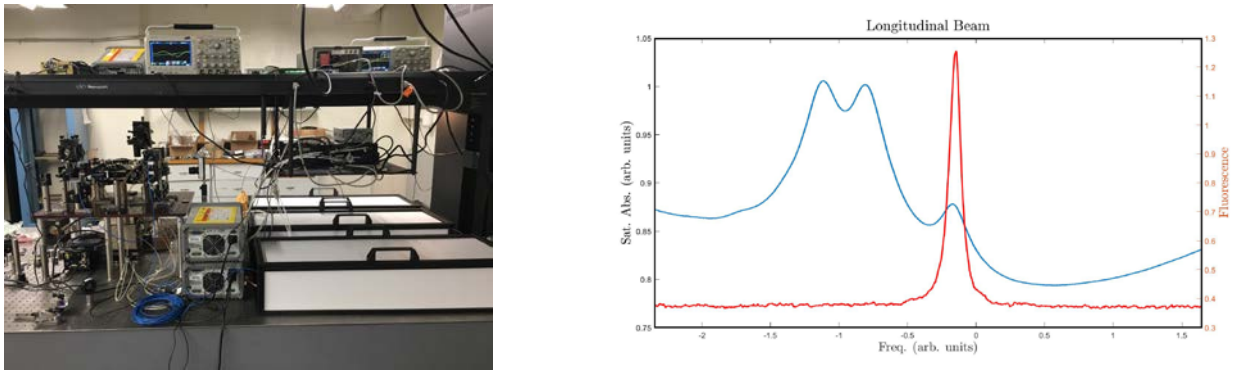

Figure 1: (Left) Picture of the current apparatus being used in our experiments. (Right) Velocity profile of the atoms (red) relative to a saturated spectroscopy signal (blue)

References

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References

[1] T.L. Gustavson, A. Landragin, and M.A. Kasevich, "Rotation Sensing with a dual atom interferometer Sagnac gyroscope", *Classical and Quantum Gravity*, 17 (12), 2385, 2000.

[2] T. Miller, M. Gilowski, M. Zainer, P. Berg, Ch. Schubert, T. Wendrich, W. Ertmer and E.M. Rasel, "A compact dual atom interferometer based on laser-cooled Rubidium", *European Journal of Physics D,* 53 (3): 273-281, 2009.