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Progress on Measurements of the Time a Tunnelling Bose-Einstein Condensate Spends in the Classically Forbidden Region JOSEPH MCGOWAN IV, DAVID SPIERINGS, AEPHRAIM STEINBERG, Univ of Toronto — We report improvements on our initial measurements of the tunnel barrier traversal time for a Bose-Einstein Condensate of rubidium 87. Our experiment measures the Larmor time of Baz' and Rybachenko, wherein the net magnetization of the tunnelling atoms is used to encode a clock. By localizing a pseudo-magnetic field inside an optical barrier, the populations of the hyperfine levels of the tunnelling condensate encode the time spent inside the barrier region. Following technical improvements to the apparatus and measurement techniques, we report notably reduced uncertainties on measured times and velocities as well as comparing times for reflected and transmitted atoms. We also note discrepancies between our results and a simple theory based on weak measurement, and we discuss possible sources of these discrepancies, including the sensitivity to exact details of the shape and symmetry of the barrier.

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