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A Compact, Microchip-Based, Atomic Clock Based on Ultracold Trapped Rb Atoms DANIEL FARKAS, JILA/University of Colorado, ALEX ZOZULYA, Worcester Polytechnic Institute, DANA ANDERSON, JILA/University of Colorado — We propose a compact atomic clock based on ultracold Rb atoms that are magnetically trapped near the surface of an atom microchip. An interrogation scheme that combines electromagnetically-induced transparency (EIT) with Ramsey's method of separated oscillatory fields can achieve atomic shot-noise level performance of $10^{-13}/\tau^{1/2}$ for 10^6 atoms and an interrogation time of 1 s. A two-color Mach-Zehnder interferometer can detect a 100 pW probe beam at the optical shot-noise level using conventional photodetectors. This measurement scheme is non-destructive and therefore can be used to increase operational duty cycle by reusing the trapped atoms between clock cycles. Numerical calculations of the density matrix equations are used to identify realistic operating parameters at which AC Stark shifts are eliminated. By considering fluctuations in these parameters, we estimate that AC Stark shifts can be canceled to a level better than 2×10^{-14}.

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