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SALIM et al.(10) **Pub. No.: US 2022/0393691 A1**(43) **Pub. Date: Dec. 8, 2022**(54) **FREQUENCY MODULATION
SPECTROSCOPY WITH LOCALIZED
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CPC . **H03L 7/26** (2013.01); **G04F 5/14** (2013.01)(71) Applicant: **ColdQuanta, Inc.**, Boulder, CO (US)(72) Inventors: **Evan SALIM**, Lafayette, CO (US);
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(US)(57) **ABSTRACT**

A frequency-modulated spectrometry (FMS) output is used to stabilize an atomic clock by serving as an error signal to regulate the clock's oscillator frequency. Rubidium 87 atoms are localized within a hermetically sealed cell using an optical (e.g., magneto-optical) trap. The oscillator output is modulated by a sinusoidal radio frequency signal and the modulated signal is then frequency doubled to provide a modulated 788 nm probe signal. The probe signal excites the atoms, so they emit 775.8 nm fluorescence. A spectral filter is used to block 788 nm scatter from reaching a photodetector, but also blocks 775.8 nm fluorescence with an angle of incidence larger than 8° relative to a perpendicular to the spectral filter. The localized atoms lie within a conical volume defined by the 8° effective angle of incidence so an FMS output with a high signal-to-noise ratio is obtained.

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Frequency Modulation Spectroscopy System 100

