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Absolute Optical Frequency Measurements of the Cesium D1 Transitions in a Thermal Atomic Beam using a Femtosecond Laser Frequency Comb CAROL E. TANNER, VLADISLAV GERGINOV, KEITH CALKINS, Department of Physics, University of Notre Dame, SCOTT DIDDAMS, ALBRECHT BARTELS, J. MCFERRAN, LEO HOLLBERG, Time and Frequency Division, NIST Boulder — High resolution spectroscopy of the cesium D1 line is performed in a thermal atomic beam using a narrow linewidth CW diode laser offset locked to a single tooth of a femtosecond laser frequency comb. A computer controlled RF synthesizer changes the offset frequency, thus scanning the optical frequency of the probe laser. A photodiode collects the fluorescence and the signal is recorded by a computerized data acquisition system. The 1st order Doppler shift is eliminated by orienting the laser beam in a direction perpendicular to the atomic beam. Optical frequencies for all four pairs of hyperfine components are measured independently from which the D1 line centroid and excited state hyperfine splitting are obtained. The combination of our results with those of recoil-shift atom interferometry experiments can be used to determine a new value for the fine structure constant. This work is partially supported by the National Science Foundation under grant number PHY99-87984.

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