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Quantum beat spectroscopy of Rydberg hyperfine structure[1] HUY NGUYEN, JACOB LAMPEN, MATTHEW WINCHESTER, PAUL BERMAN, ALEX KUZMICH, University of Michigan — Measurements of the hyperfine interval ν_{hfs} for highly excited Rydberg levels are challenging since the interval scales inversely with principal quantum number $\propto n^{-3}$. In our experiment a sample of ultracold Rb atoms is prepared in a state-insensitive lattice to preserve ground-Rydberg atomic coherence. A two-photon 5s-ns transition is used to excite a manifold of nuclear Zeeman states in the Paschen-Back regime with energy splittings $\approx \nu_{hfs}/4$. Time-dependent atomic interference between the nuclear Zeeman states modulates the polarization of the coherently retrieved light field on a $\sim 10\mu s$ timescale. The effect of nuclear state dependent light shifts on the observed beat frequency is investigated, and ν_{hfs} is measured for principal quantum numbers between 30 and 50.

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