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**Accessing Rydberg-dressed interactions using many-body Ramsey dynamics** RICK MUKHERJEE, THOMAS KILLIAN, KADEN HAZZARD, Rice University — We demonstrate that Ramsey spectroscopy can be used to observe Rydberg-dressed interactions in a many-body system. Our scheme operates comfortably within experimentally measured lifetimes, and accesses a regime where quantum superpositions are crucial. We build a spin-1/2 from one level that is Rydberg-dressed and another that is not. These levels may be hyperfine or long-lived electronic states. An Ising spin model governs the Ramsey dynamics, for which we derive an exact solution. Due to the structure of Rydberg interactions, the dynamics differs significantly from that in other spin systems. As one example, spin echo can *increase* the rate at which coherence decays. The results are relevant for the current ongoing experiments, including those at Rice University.

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