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Tailoring interactions with light and Rydberg states

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By virtue of their large polarizability, ultracold Rydberg atoms hold promise for exploring long-range interacting quantum systems. In this talk, I will describe different ideas to generate tunable interactions between ultracold atoms via virtual excitation of Rydberg states. This includes finite-range interactions in quantum gases and various kinds of spin interactions in synthetic quantum magnets formed by atomic lattices. Recent experimental results on both approaches will also be discussed.