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Molecular SuperRotors: Control and properties of molecules in extreme rotational states

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Extremely fast rotating molecules, known as "super-rotors", may exhibit a number of unique properties, from rotation-induced nano-scale magnetism to formation of macroscopic gas vortices. Orchestrating molecular spinning in a broad range of angular frequencies is appealing from the perspectives of controlling molecular dynamics. Yet in sharp contrast to an optical excitation of molecular vibration, laser control of molecular rotation is rather challenging. I will report on our recent progress in generating and controlling molecular super-rotors (e.g. oxygen molecules occupying ultrahigh rotational states, J > 120, or carbon dioxide with J>400) with a specially designed intense laser pulses, known as an "optical centrifuge". I will discuss the results of our study of collisional, optical and magnetic properties of molecular superrotors.

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