Molecular Superrotors: effects of ultrafast rotation on magnetic and acoustic properties of molecular ensembles

Valery Milner
Department of Physics & Astronomy, University of British Columbia

It has been speculated that extremely fast rotating molecules, known as “superrotors”, 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. In this talk, I will report on our recent progress in generating and controlling molecular superrotors (e.g. oxygen molecules occupying ultrahigh rotational states, $J > 120$) 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, as well as our recent observation of the molecular cogwheel states.