Ben-Gurion University of the Negev

אוניברסיטת בן גוריון בנגב

Special Seminar

Department of Chemistry

Monday, September 4th, 2023
Time: 14:30
Bldg. 43 Room 015

Prof. Bryan Changala

Center for Astrophysics Harvard & Smithsonian Cambridge, Massachusetts, 02138 USA

Exotic molecules in the laboratory and space: Probing chemistry and electronic properties with high-resolution microwave spectroscopy

The key molecules that drive the chemical evolution of diverse environments, from Earth's atmosphere to circumstellar and interstellar space, are often highly reactive, short-lived species with exotic molecular structures and properties. A coordinated effort combining laboratory experiments, theoretical quantum chemistry, and observational astronomy is necessary to understand the formation and fate of these molecules in extreme astrophysical conditions. I will describe how we use microwave spectroscopy as a tool to sensitively detect and exhaustively characterize complex molecules; interpret the chemical implications of these measurements with sophisticated ab initio electronic structure and quantum nuclear motion theory; and use these data to search for evidence of new molecules in space with large radio telescopes. This joint approach has proved crucial to addressing the un- expectedly complex organic chemistry of polycyclic aromatic hydrocarbons recently revealed in the interstellar medium and new metal-organic chemistry occurring in the outflows of evolved carbon-rich stars. Our experimental and theoretical results provide unique insights into molecular physics applications more broadly, including laser-cooling of metal-organic polyatomic molecules, which highlights the impact of these methods in molecular quantum science at large.