Physical Research Laboratory, Ahmedabad

COLLOQUIUM - 13 – 29

Speaker: **Prof. E. Arunan**

Department of Inorganic and Physical Chemistry, Indian Institute of Science, Bangalore.

Title: **Molecular Beam Microwave Spectroscopy: Applications in Radio-astronomy and Intermolecular Bonding**

Abstract

Microwave spectroscopy has played a major role in identifying molecules in space. Our laboratory has built a molecular beam microwave spectrometer, which is one of about 15 all over the world. This spectrometer has a range of 2-26 GHz and the typical line width is only a few kHz enabling measurement of molecular frequencies to 9 or 10 significant figures. We have used this spectrometer to record the microwave spectrum of various molecules and also their weakly bound complexes formed under supersonic jet conditions. Among the molecules recently investigated in our laboratory, two are of interest to astrophysics: phenylacetylene and propargyl alcohol. Both are crucial intermediates to the formation of poylycyclic aromatic hydrocarbons (PAH) which lead to interstellar dusts and also soot particles in diesel engines. While the mechanism of PAH formation (2 dimensional growth) is well established, how do PAH become soot (3 dimensional growth) is not well understood. Weakly bound molecular complexes are proposed as intermediates to soot formation. As our spectrometer is equipped with a molecular beam source, such molecular complexes can be formed and investigated. Structures of these molecular complexes are governed by intermolecular interactions which were typically classified as van der Waals interaction and hydrogen bonding. However, there has been a continuous debate about how these two interactions were different. Comprehensive experimental and theoretical studies in our laboratory helped us understand these interactions with unprecedented clarity. This also led us to initiate and complete an IUPAC project to redefine hydrogen bonds. Our work on Argon-propargyl alcohol complex also led us to define a 'carbon bond' analogous to the 'hydrogen bond'. Carbon bonding appears to be important in hydrophobic interactions and also in SN_2 reactions. Following our predictions, experimental evidence for carbon bonding has been found using charge density analysis in crystal structure.

The Speaker

Prof. E. Arunan did his B. Sc. (1982) in American College, Madurai, M. Sc. (1984) and M. Tech (1986) from IIT Madras and Delhi, respectively. He obtained his Ph. D. (1991) from the Kansas State University. He was a postdoctoral associate at the University of Illinois at Urbana-Champaign before moving to India in 1994. He has established two experimental laboratories in the Indian Institute of Science, both having unique home-built facilities. He is on the International Advisory Editorial board of Physical Chemistry Chemical Physics, published by the Royal Society of Chemistry. He is an Associate Editor of both Current Science and Journal of Chemical Sciences, published by the Indian Academy of Sciences. He is a fellow of the International Union of Pure and Applied Chemistry and the Indian Academy of Sciences. He has published more than 70 papers in peer reviews research journals and published more than 20 articles in science magazines like Resonance.

Wednesday: 27 November, 2013, 16:00 hrs

K.R. Ramanathan Auditorium, PRL

Tea at 15:30 hrs

ALL ARE WELCOME