



# LHD International Lecture



## **Title:** Modeling of Vibrational Excitation and Dissociation for Hypersonic Nonequilibrium Simulations

**Lecturer:** Dr. Jiaao HAO

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The Hong Kong Polytechnic University

**Venue:** Room 312, Building 1, Institute of Mechanics, CAS

**Time:** 11:00-12:00am, February 28, 2018



### **Abstract:**

The development of next generation hypersonic vehicles relies on the accurate prediction of the flow field characteristics at extremely high velocity, which requires computational fluid dynamics (CFD) tools to fully account for the multiple physicochemical phenomena such as vibrational excitation, dissociation, ionization, and radiation. In this study, particular emphasis is given to the coupling process of vibrational excitation and dissociation. Models with various levels of fidelity are discussed including a conventional two-temperature model, two improved models established based on the maximum entropy principle, and a state-specific method. Distributions of vibrational temperature and species number density behind a normal shock wave in oxygen are predicted using these models and compared with existing shock tube experimental data. The results show that non-Boltzmann effects are essential to reproduce the experiments under the conditions with intense thermochemical nonequilibrium.

### **Biography:**

Dr. Jiaao HAO is currently a Research Assistant in the Department of Mechanical Engineering at the Hong Kong Polytechnic University. He obtained his Ph.D. in Fluid Mechanics and the B.E. degree in Aircraft Design and Engineering from Beihang University in 2018 and 2013, respectively. His current research focuses on hypersonic nonequilibrium flows, computational fluid dynamics, and turbulent flows.