



**Guangdong Technion**

Israel Institute of Technology

广东以色列理工学院

Mechanical Engineering  
and Robotics Department:

**KDF Seminar Lecture**



## **Explosive Boiling of Drops Near a Solid Surface and Inside a Turbulent Flow**

*Speaker: Professor Chao Sun*

**Tuesday, July 26 at 10:00 am Israel time**

**Zoom ID: 973 4225 5081**

**Abstract:** In this talk, we will discuss two problems. The first problem is about the evaporation dynamics of Leidenfrost drops. The gasification of multicomponent drops is relevant in various energy-related technologies. An interesting phenomenon associated with this process is the self-induced explosion of the drop, which promotes drop atomization. We study a unique explosive gasification process of a suspension (solid-liquid) droplet and a tri-component (liquid-liquid) droplet in a levitated Leidenfrost state. As the droplet evaporates, microparticles accumulate at the droplet-air interface and form a particle shell, resulting in reduced evaporation rate and contact with the substrate. For the tri-component droplet consisting of water, ethanol, and oil (ouzo), the evaporation process is even richer. The preferential evaporation of the most volatile component, ethanol, triggers nucleation of the oil micro-droplets in the remaining drop, and finally leads to the drop explosion. These phenomena illustrate the rich evaporation dynamics of Leidenfrost drops. The second problem is about turbulent flow with boiling drops. Turbulence is known for its ability to vigorously mix fluid and transport heat. We have conceptualized a kind of “active particle” turbulence, which far exceeds the limits of classical thermal turbulence. By adding a minute concentration of a heavy liquid to a water-based turbulent convection system, a remarkably efficient biphasic dynamics is born. We find that the heat transfer enhancement is dominated by the kinematics of the active elements (bubbles and drops) and their induced-agitation.

**Speaker Bio:** Chao Sun is a professor at the Center for Combustion Energy, and the Department of Energy and Power Engineering, and the Department of Engineering Mechanics at Tsinghua University in China, and he is also a part-time professor at the Physics of Fluids Group at University of Twente in the Netherlands. He obtained his PhD from the Chinese University of Hong Kong in 2006. From 2009 to 2015, he was a faculty member at the University of Twente in the Netherlands. In 2015, he moved to Tsinghua University as a full Professor. His research interests include multiphase flows, high-Reynolds number turbulence, bubbles and droplets, and heat and mass transfer. He authored two review articles for Annual Reviews on ‘High-Reynolds Number Taylor-Couette Turbulence’ and ‘Bubbly and Buoyant Particle-Laden Turbulent Flows’. He was a plenary lecturer for the 10th International Conference on Multiphase Flow, and a keynote speaker for the 15th European Turbulence Conference. He is a fellow of the American Physical Society and a recipient of the Xplorer prize, and serves as an associate editor of International Journal of Multiphase Flow, an editor of Journal of Turbulence, and an editorial member of Physical Review Fluids, Acta Mechanica Sinica, Journal of Hydrodynamics, and Experiments in Fluids.