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**北京大学工学院**

**航空航天工程系**

湍流与复杂系统国家重点实验室



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| **Flame instability and Taylor dispersion** |

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**Abstract:**

The coupling between **Taylor dispersion** (or shear-flow enhanced diffusion) and flame instabilities is a scientifically rich research topic whose investigation we have recently initiated in the form of several dedicated recently published studies and ongoing investigations. In this talk, I will give and overview of the novel aspects and significance of these studies, both for premixed and diffusion flames. The topic is particularly pertinent to reactive-diffusive processes taking place in small-scale slender geometries, and the needed theoretical tools fall within the scope of the lubrication theory in fluid mechanics, which we extend to account for Taylor dispersion in reaction-diffusion systems. Several experimental studies conducted in micro-combustion have documented some odd observations in relation to the formation of cellular patterns. In particular, cellular patterns are observed for reactants with large Lewis numbers, although typically a Turing-like instability would be predicted to cause such patterns to appear in reactants with small Lewis numbers. We show that the identified coupling mentioned above is able to explain these odd observations. More generally, a particularly interesting aspect common to our studies is the fact that Taylor dispersion leads effectively to **anisotropic diffusion** and that **effective flow dependent Lewis numbers** can be identified which have major impact on flame stability and its burning rate or propagation speed.

**Brief Biography:**

Joel Daou is associate professor in Applied Mathematics at the University of Manchester, UK, where he directs the research activities in combustion theory. His expertise and publications span wide areas including ﬂame propagation in non-homogeneous mixtures, droplet combustion, ﬂame-ﬂow interaction, and ﬂame stability. He has made several pioneering contributions in the field, including the first investigations on the effect of Lewis numbers and heat-loss on triple flames, the identification of flame tubes in mixing layers, the introduction of the thick flame asymptotic limit in premixed combustion, the introduction of flame ball in mixing layers as a theoretical framework for the forced ignition of diffusion flames, and the first study on Taylor dispersion in combustion. He has worked and published with top combustion scientists in vibrant research institutions in France, Germany, Spain, USA and the UK.

**时间：2023年10月23日（周一）上午9:00－10:00**

**地点：北京大学 工学院 1#楼212会议室**

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