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学术报告

Turbulent Aerosols

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Abstract

In this talk I describe recent progress in understanding the dynamics of heavy particles in turbulent flows.Many processes in nature and technology are determined by the dynamics of particles suspended in turbulent and mixing flows. The subject has a long history. Smoluchowsky (1917) pointed out that chemical reactions can be accelerated by stirring, because this induces encounters between the reactants. Saffman & Turner (1956) applied this principle to rain clouds, arguing that turbulence induces collisions and coalescences between microscopic water droplets thus accelerating rain initiation. But despite intensive research during the past 60 years this process is not understood. The problem is that we know too little about the dynamics of particles in turbulence. How does the turbulent motion influence the collision rate of the suspended particles? What are typical collision velocities? What does the spatial distribution of the suspended particles look like? There has been recent progress in answering these questions, based on statistical-model calculations. I describe these models, summarise the results obtained, and discuss a number of open questions. The statistical model has been successfully used in other contexts too. To give an example I conclude by describing recent statistical-model results for the dynamics of motile micro-organisms in turbulence.

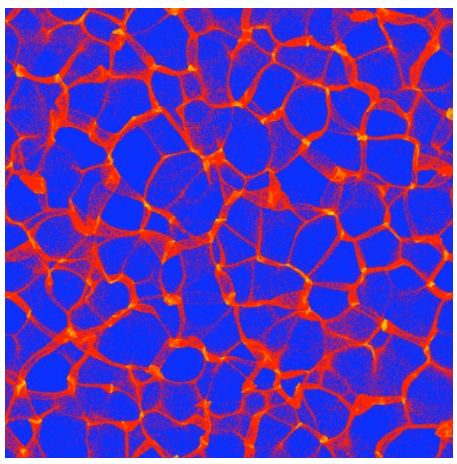

Figure 1: Model calculation. Spatial distribution of heavy particles in a random flow. The patterns look like light patterns seen at the bottom of a swimming pool on a sunny day.

Figure 1

Biography

Bernhard Mehlig, 瑞典哥德堡大学教授， 1994 年获得斯图加特大学物理学博士。2001-2002 年期间在哥德堡大学担任副教授，2002 年至今担任哥德堡大学教授。曾获得马普学会奥托-哈恩奖章（1995）、自然科学和医学研究基金会 和瑞典皇家科学院的物理学中的“Gustafsson Priset”（2010）、哥德堡皇家艺术与科学院成员（2015）、哥德堡大学自然科学学术部物理学奖（2017）。Bernhard Mehlig 教授长期从事复杂系统的研究工作，在 Advances in Physics, Phys. Rev. Lett, Journal of Fluid Mechanics, Journal of Mathematical Physics 等重要物理期刊上共发表文章 100 余篇，内容涉及统计物理、生物物理和种群生物学等相关领域。

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