Physical Sciences

Turbulence and the Stabilization Principle

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Further results of research, reported in several previous *NASA Tech Briefs* articles, were obtained on a mathematical formalism for postinstability motions of a dynamical system characterized by exponential divergences of trajectories leading to chaos (including turbulence).

To recapitulate: Fictitious control forces are introduced to couple the dynamical equations with a Liouville equation that describes the evolution of the probability density of errors in initial conditions. These forces create a powerful terminal attractor in probability space that corresponds to occurrence of a target trajectory with probability one. The effect in ordinary perceived three-dimensional space is to suppress exponential divergences of neighboring trajectories without affecting the target trajectory. Consequently, the postinstability motion is represented by a set of functions describing the evolution of such statistical quantities as expectations and higher moments, and this representation is stable.

The previously reported findings are analyzed from the perspective of the authors' Stabilization Principle, according to which (1) stability is recognized as an attribute of mathematical formalism rather than of underlying physics and (2) a dynamical system that appears unstable when modeled by differentiable functions only can be rendered stable by modifying the dynamical equations to incorporate intrinsic stochasticity.

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Improved Cloud Condensation Nucleus Spectrometer

Droplets can be sampled over a wide range of supersaturations in a short time.

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An improved thermal-gradient cloud condensation nucleus spectrometer (CCNS) has been designed to provide several enhancements over prior thermal-gradient counters, including fast response and high-sensitivity detection covering a wide range of supersaturations. CCNSs are used in laboratory research on the relationships among aerosols, supersaturation of air, and the formation of clouds. The operational characteristics of prior counters are such that it takes long times to determine aerosol critical supersaturations. Hence, there is a need for a CCNS capable of rapid scanning through a wide range of supersaturations. The present improved CCNS satisfies this need.

The improved thermal-gradient CCNS (see Figure 1) incorporates the following notable features:

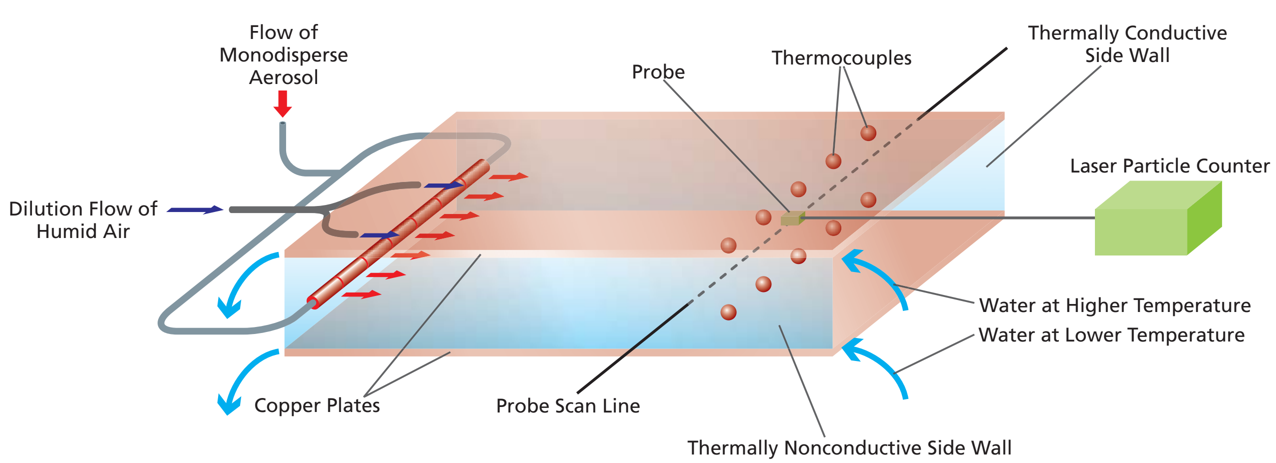

Figure 1. In the **Improved Thermal-Gradient CCNS**, a gradient supersaturation field is established in the main chamber. The probe is moved along the width axis to sample droplets over a range of supersaturations.