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 incorporates the following notable features:

- Improved Cloud Condensation Nucleus Spectrometer
- Droplets can be sampled over a wide range of supersaturations in a short time.

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

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Better Modeling of Electrostatic Discharge in an Insulator

A model based on Kohlrausch relaxation gives improved fits to experimental data.

NASA’s Jet Propulsion Laboratory, Pasadena, California

An improved mathematical model has been developed of the time dependence of buildup or decay of electric charge in a high-resistivity (nominally insulating) material. The model is intended primarily for use in extracting the DC electrical resistivity of such a material from voltage-vs.-current measurements performed repeatedly on a sample of the material over a time comparable to the longest characteristic times (typically of the order of months) that govern the evolution of relevant properties of the material. This model is an alternative to a prior simplistic macroscopic model that yields results differing from the results of the time-dependent measurements by two to three orders of magnitude.

The present model is based on the Kohlrausch relaxation law, named after its author, who first reported a long-lasting dielectric relaxation in 1854. Since then, the Kohlrausch law has been used to describe a myriad of physical phenomena. Kohlrausch relaxation is also known as stretched exponential relaxation because the time-dependent value of a Kohlrausch-relaxing quantity of interest is proportional to the stretched exponential function \( \exp\left(-t/\tau^\beta\right) \).