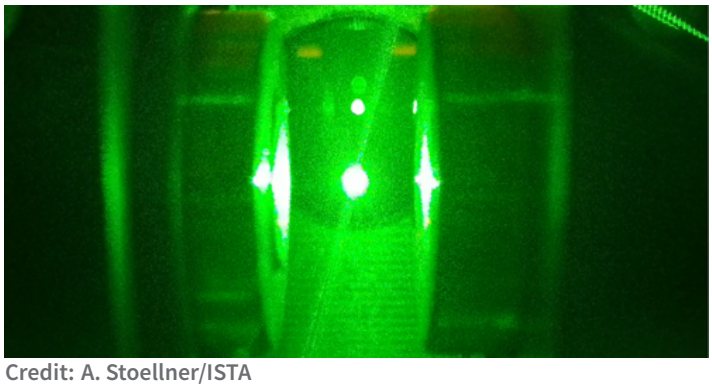
# Getting a Charge from a Laser Beam

**The laser that levitates a microscale particle can also charge it up, providing a useful tool for lab-based experiments for atmospheric science.**

By **David Ehrenstein**

Many mysteries surround the interactions of micrometer-scale charged particles in the atmosphere, including their effects on lightning and clouds. Atmospheric scientists can study a levitated charged particle in a laser trap produced by so-called optical tweezers. Now graduate student Andrea Stoellner at the Institute of Science and Technology Austria (ISTA) and her colleagues have demonstrated how to use the laser to place a precise amount of charge on the particle [**1**]. Their approach is simpler and provides more control than previous techniques.

The standard method to charge up a levitated, neutral particle such as a silica sphere is to ionize the air and then apply an electric field to draw ions toward the particle, hoping that one will stick. "Our technique takes the guesswork out," Stoellner says. She and her colleagues noticed the effect when they were preparing an experiment to observe the impact of humidity and other conditions on the charge of a silica sphere, which represented an atmospheric ice particle. "We never expected that the laser would charge the particle," recalls team leader Scott Waitukaitis of ISTA.



Credit: A. Stoellner/ISTA

The researchers measured the charge increase over time as the particle was held in the optical tweezers. In tens of minutes the particle went from neutral to a positive charge of over 300 times the electron's charge, enough to generate discharge events that Stoellner and colleagues call microsparks. The team developed a theoretical model that explains the charging process as being caused by pairs of photons ejecting single electrons from the particle. With the new technique, the researchers hope to learn how lightning is triggered on the microscale and how long the charge on an atmospheric microparticle lasts.

David Ehrenstein is a Senior Editor for *Physics Magazine*.

## REFERENCES

1. A. Stoellner *et al.*, "Using optical tweezers to simultaneously trap, charge, and measure the charge of a microparticle in air," **Phys. Rev. Lett. 135, 218202 (2025).**