ALPhA Advanced Laboratories

ALPhA's Laboratory Immersions

ELectrodynamic Ion Trapping

California Institute of Technology, June 21–23, 2017.

(One set-up available for four participants)

Host and Mentor

Eric Black is a Lecturer of Physics at the California Institute of Technology. He received his Ph.D. in condensed-matter physics from the University of Colorado at Boulder in 1997 before coming to Caltech, first as a postdoc and then as a staff scientist, as part of the Laser Interferometer Gravitational-wave Observatory (LIGO) project. He currently teaches Caltech's freshman and senior physics laboratories.

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Kenneth G. Libbrecht (B.S., Caltech; Ph.D. Princeton) is professor of physics at the California Institute of Technology where he is involved in the Laser Interferometer Gravitational Wave Observatory (LIGO), the growth of crystals, notably snow crystals, and physics education. He has helped turn a number of Caltech's new experiments for the teaching labs into commercial products, which may be seen at http://newtonianlabs.com and in this Immersion.

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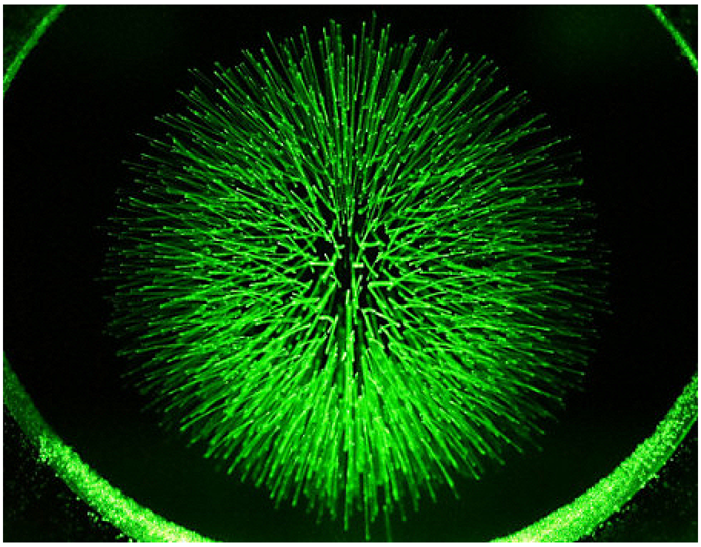
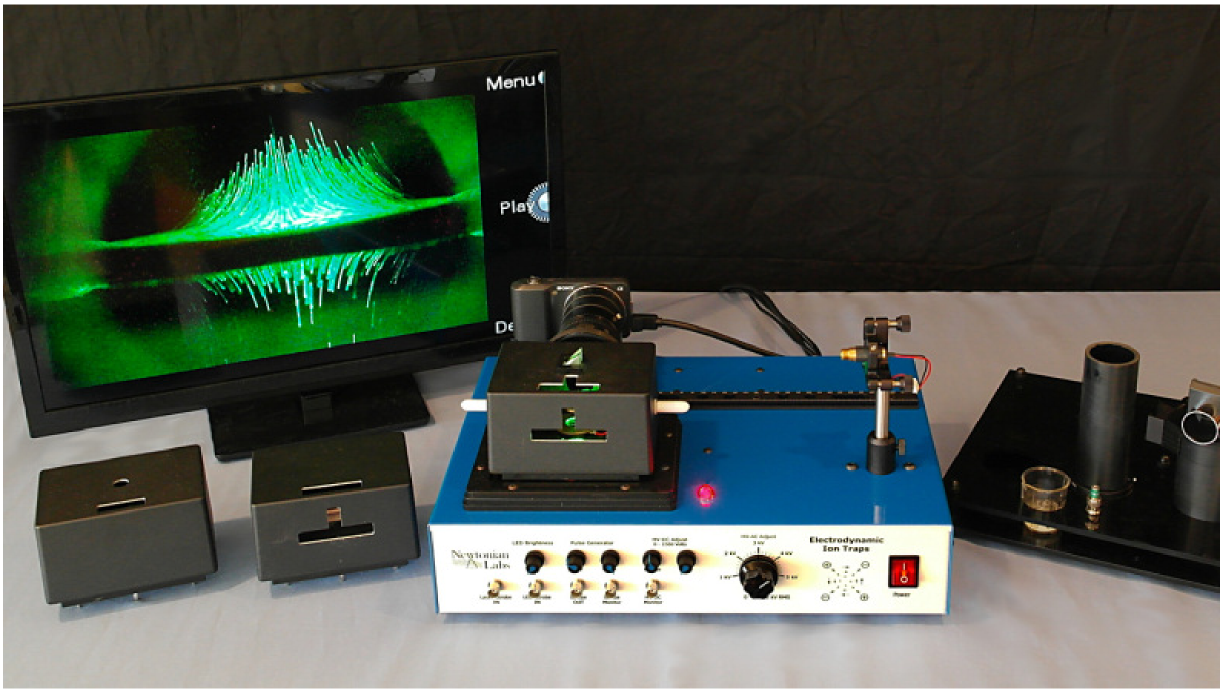
Electrodynamic ion traps, also known as Paul traps, are often used to hold individual atomic or molecular ions in free space, and these traps are commonly used as starting points for physics experiments investigating atomic or molecular properties. Wolfgang Paul and Hans Dehmelt received the Nobel Prize for Physics in 1989 for developing ion traps, and this technology is still in widespread use today.



Trapping individual atoms is quite difficult, requiring lots of time and expensive equipment. In this workshop you will be trapping and observing larger particles, about twenty-five microns in diameter, which is significantly easier but involves many of the same underlying physical principles as trapping individual atoms. Also, they are easier to see. In this lab you will be working with different types of ion trapping geometries, examining their characteristics, and making some measurements of individual trapped particles.



Pricing and documentation including videos, a guide to experiments, a sample student handout, and detailed information about the physics of the trap are available at the Newtonian Labs website.

Please note that the Jonathan F. Reichert Foundation has established a grant program (ALPhA webpage; Foundation website) to help purchase apparatus used in Laboratory Immersions. Limitations and exlusions apply, but generally speaking the foundation may support up to 40% of the cost of the required equipment.
