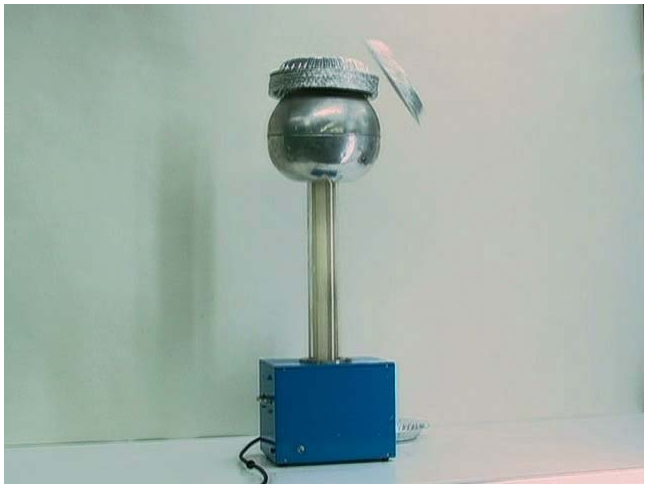
Answer #357

The answer is (f) other: the pie pans will leave the top of the Van de Graaff one at a time, being pushed upward by the electric field and falling sidewise more or less randomly.



Alternate high-res version.

When you energize the Van de Graaff generator, the pie pans all get charged, along with the dome. However, all pie pans do not get charged the *same* way; the charge is *not* distributed uniformly inside all the pie pans.

By Gauss' law, the charge rushes to outside of the conducting surface, which in our case happens to to be both the top of topmost pie plate, as well as the edges of all the other pie pans.By a sheer difference in surface area, most of the charge will collect on the top pie plate, leaving a relatively small amount of charge around the edges of the other pie pans.

As the charge builds and builds, the top pie pan collects so much charge so as to launch itself from the rest, its like charge repelling that of the rim below it. Each plate is then charged in turn from the top down, and when the *critical value* of charge is reached the process continues and sends another pie pan towards freedom.

Inevitable imperfections in our (high quality) silverware will assure that each rim is not perfectly circular. Since the topmost pan is pushing itself off of this not-so-perfect rim, the pie pan does not simply "levitate" because the repulsion is not perfectly isotropic. Any small unbalance between the electrostatic and gravitational force will make the pie pan veer off in a completely different direction, making it unpredictable to know in which direction the pie pans will fall!

Question of the Week

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For questions and comments regarding the *Question of the Week* contact Dr. Richard E. Berg by e-mail or using phone number or regular mail address given on the Lecture-Demonstration Home Page.