Attract, Repulse - Rotate! Electrical Force Does More Than Push and Pull

"We have only looked at the electrostatic case. We have no magnetic fields here, nothing is moving, there is no current, only the charges sitting stationary on these conducting metal spheres. So, what we observe is just action of charges causing this rotation of the spheres."

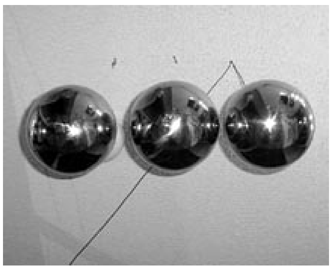
- Anders Wistrom, Ph.D., Univ. of California-Riverside

April 8, 2003 Riverside, California - War and disease are not the only forces of change in the world around us. This week, even electricity was updated. The University of California, Riverside sent out a news release entitled, "UC Riverside researchers' discovery of electrostatic spin challenges century-old theory. New physical phenomenon will likely impact atomic physics, chemistry and nanotechnology."

The scientists who have discovered electrostatic rotation are Anders Wistrom, Ph.D., and Armik Khachatourian, Ph.D. Their work has been published in both the *Journal of Mathematical Physics* and *Applied Physics Letters* and shows that when a direct current voltage is applied to three metal spheres suspended without friction, the spheres begin to rotate. This newly documented phenomenon has been named "electrostatic rotation."

This was a surprise and could not be explained by available theory. Since Lord Kelvin in the 19th Century postulated his ideas about electrical potential surrounding charged objects, no one apparently had questioned that he might not have the whole story. Now, the UC-Riverside team's revelation could change the way we look at atoms, molecules and maybe even propulsion systems.

Dr. Wistrom told me today that in their laboratory, he puts one metal sphere on a stand that can be charged with DC voltage. Then he hangs two more metal spheres by thin plastic or metal wire so that the three spheres are in a triangle formation with each other. As long as the DC voltage is applied to the sphere on the stand, the other two free-hanging spheres will rotate into a new position. The spheres will keep rotating until the wires holding the metal spheres stiffen and prevent further rotation. What would happen if the wires weren't there?

Photograph of experimental assembly with stainless-steel spheres. Two spheres are free to rotate
about an axis perpendicular to the plane connecting the centers of the three spheres. The third sphere

(to which the power supply is connected) is fixed on a stationary stand. (A) shows a planar configuration
in which the rotation is clockwise for the two upper spheres (the third sphere is held stationary. (B) is a linear
configuration in which rotation was not observed. Photographs © 2002 by Anders Wistrom and Armik Khachatourian.

Interview:

Asst. Professor Anders Wistrom, Ph.D., Dept. of Chemical and Environmental Engineering, University of California - Riverside, Riverside, California: "Once we turn on the current, what we note then is that the spheres begin to twist in one orientation or another. Then after some time, we will have a slight oscillation and they will find a new position that is offset from the original one.

We have only looked at the electrostatic case. We have no magnetic fields here, nothing is moving, there is no current, only the charges sitting stationary on these conducting metal spheres. So, what we observe is just action of charges causing this rotation of the spheres.

WHY IS THIS AN UNEXPECTED RESULT?

The result itself, when one considers that it's just a symmetry of charges on the surface, it appears very intuitive that this would happen. However, over the last 100 years or so, it has been stated that the direction of the electric field is perpendicular to the surface of the conductor. With that assumption, it follows that any rotation cannot take place. So, the question is: why was this assumption made in the first place and why has it persisted for so long?

Of course, it's difficult to read the minds of these giants in science that came before us, like Thompson and Maxwell and these innovators of enormous importance to us. But one explanation could be that at the time in the mid-1800s, people were not interested, or scientists and engineers were not interested in electrostatic phenomena. At the time, that was mainly parlor games you can push the comb through your hair and you can lift small objects and it was a nice conversation piece. At the time, the scientific interest was to unify the theory of magnetism with electricity and combine that into one unified theory. That at the time was much more important because it had implications for communications. The first trans-Atlantic cables were built at that time. William Thompson, who later became Lord Kelvin, was instrumental in calculating some of the properties of cables for communications.

It was those aspects that were important. The assumption that an electric field is perpendicular to the surface provided a wonderful way where the equations could be written in vector form and this provided the mathematical tools to unify magnetism with electricity.

For our experiments, we built several different experimental set ups using small metal spheres ranging in sizes from about 2 centimeters to 25 centimeters in diameter. We suspended them using monofilament nylon in some cases, very thin steel wires in other cases, from the ceiling or from the support of a surrounding box we built specifically for the purpose. In some instances, we supported one of the spheres with a rigid stand by which we could connect that sphere to a power supply.

THE OTHER TWO SPHERES WERE HUNG TO REDUCE FRICTION?

Exactly, strings or very thin metal wires that varied in length maybe from 10 centimeters up to a meter.

ONLY THE TWO FREE-HANGING SPHERES BEGIN TO ROTATE AND THE ONE THAT IS ON THE STAND DOES NOT?

Yes, exactly.

WHICH WAY DO THOSE SUSPENDED BY THE WIRE OR THREAD GO?

In the configuration we have reported in our papers, they go in opposite directions.

A STATEMENT IN THE NEWS RELEASE SAID: "THE EFFECTS ARE PARTICULARLY NOTICEABLE WHEN THE SPHERES ARE VERY CLOSE TO ONE ANOTHER."

Yes. According to the experiments we have done and also according to the calculations, it appears as though the torque is proportional to the inverse of the distance to the 4th power.

SO, THE CLOSER THEY ARE, THE FASTER THEY SHOULD SPIN.

Or the stronger the torque, exactly. Of course, that leads to some experimental complications because if in the laboratory we bring the spheres too close together, then we will have current flowing from one sphere to the other. We have limitations. We have to have an air gap big enough to prevent that leap of current.

IF THE SPHERES WERE ATTACHED TO SOME SORT OF CYLINDER OR PLATE THAT COULD MOVE AND IF YOU SCALED IT UP TO A LARGER SCALE, IT'S POSSIBLE THAT SPHERES THAT HAD THIS ELECTROSTATIC CHARGE COULD THEN BEGIN TO ROTATE IN A SYSTEM THAT WAS RELATED TO PROPULSION.

It could be possible. I can see very difficult engineering problems in controlling friction and how to put a device like that together. But in the absence of all other disturbances, yes. Then you would have a motor, if you will.

IS THERE ANYTHING IN AN ELECTROMAGNETIC FIELD THAT COULD SUBSTITUTE FOR A WIRE WHERE YOU WOULD BE SUSPENDING THEM (SPHERES) IN SOME WAY WITHOUT PHYSICAL MATTER?

I don't know. It's a very interesting question that you are asking and I think ultimately it might be a very important question on how to conduct an experiment without any physical restraints. Right now, I can't imagine a way to do that. But again, hopefully what we are looking for is more scientists and engineers will be interested in our findings and come up with ideas of that nature.

WHAT KIND OF RESPONSE HAVE YOU HAD FROM OTHER PHYSICISTS AND ENGINEERS AND OTHERS?

People have been very curious and congratulatory. I had an e-mail today from someone who is trying to set up their own experiments in their laboratory. That to me is maybe the most encouraging that other people are beginning to look at what we have done and hopefully can challenge our findings or confirm our findings because again, that's how the scientific method works. Good ideas survive, bad ideas die.

WHAT'S THE NEXT BIG STEP FOR YOU?

The next big step for me is to work on the mathematical model so we can predict the magnitude of the force at very close separations, or at any separation.

WHEN YOU HAVE FUN IN YOUR MIND THINKING ABOUT HOW THIS MIGHT APPLY TO SOMETHING REALLY COOL IN THE FUTURE, WHAT DO YOU THINK ABOUT?

If we can imagine ourselves being shrunk down to molecular size and we can start manipulating molecules one at a time to assemble them or to bring them together or to react with each other. Those are the things that I have in the back of my mind that may be possible in the future."

Websites:

http://www.engr.ucr.edu/~wistrom/

Credits