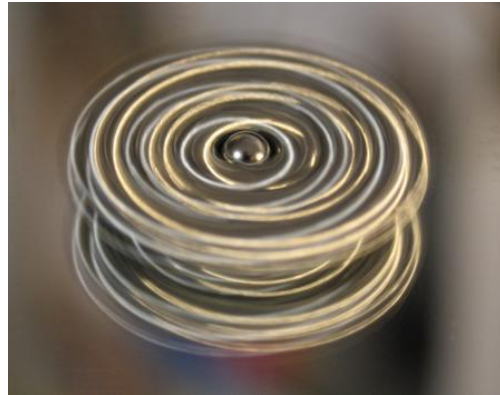


Application No. 425: Spinning top made of magnetic spheres

Author: Dr. Christian Ucke, München, Germany, christian.ucke@web.de

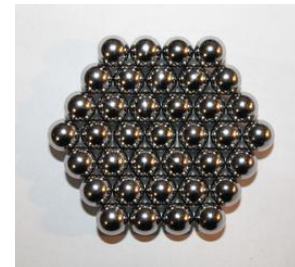
Thanks to low friction, these tops continue to spin for several minutes

Dr Ucke, co-author of our popular project "The World's Simplest Electric Motor" (www.supermagnete.fr/eng/project1), introduces simple spinning tops made of magnetic spheres. Please see the accompanying PDF document for details (available in German only). Here, we only publish an abridged version.



pdf file

When combining 37 magnetic spheres type K-06-C (www.supermagnete.fr/eng/K-06-C) as shown in the picture, the spheres form a hexagonal structure with a slightly curved surface. When this shape is placed on a glass surface with the curved side facing down, it only rests on the centre sphere and can be rotated easily.

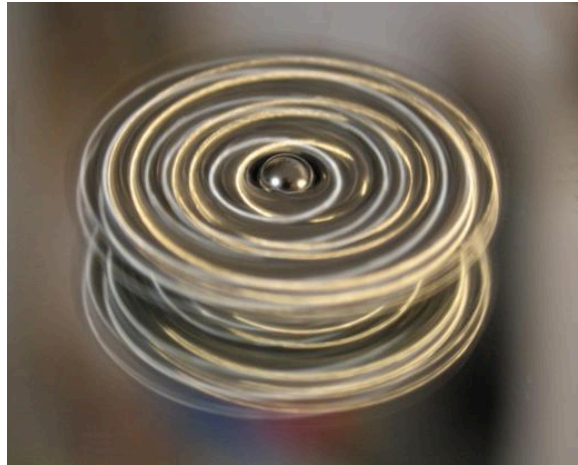


It may also be necessary to push the spheres in the middle through a little bit more with your finger, so that only the centre sphere of the spinning top makes contact, if possible. As a result, friction on the glass will be extremely low.



From the side, you can blow on the spinning top through a straw and reach a rotational speed of 10 000 revolutions per minute. That is quite an impressive speed of rotation. Yet, the centrifugal force remains too low to pull the magnets apart.

On an even surface, the spinning top will swerve slightly to the side because it is being blown on. Therefore it would be good to use a sufficiently flat, concave mirror (shaving or make-up mirror) for the experiment. It takes several minutes before the top comes to a stop. How long exactly depends very much on the surface and also whether or not there are other magnets nearby. Illuminating the spinning top with above spotlights at left and right angles will result in beautiful light patterns (see picture). On a mirror, the spinning top even doubles visually.



The sphere in the middle is always visible during rotation because the symmetrical top spins around the centre of this sphere.



Pentagonal, square or trigonal shapes are also possible instead of the basic hexagonal structure. This picture shows all of these shapes in a minimal configuration. The sphere in the centre protrudes noticeably further than in the hexagonal shape because in these shapes it can not be located on the same plane as the surrounding spheres. With these shapes, the magnetic spheres are not as easily assembled because they repel each other. These basic shapes are poorly suited as a spinning top since they are not easily set into rotating motion and have a comparatively low moment of inertia.

In the partial image to the left, the pentagonal shape was expanded to include 31 spheres in total; in a manner of speaking, it is upside down.

Below you can see this spinning top in motion (photo with 1/100 s). Because the mass centre of this top is higher than the one of the hexagonal shape, it is harder to set into motion and will spin less stable at lower rotational speeds. However, blowing on it can increase the rotational speed.





Articles used

37 x K-06-C: Sphere magnet Ø 6 mm (www.supermagnete.fr/eng/K-06-C)

Online since: 08/12/2010

The entire content of this site is protected by copyright. Copying the content or using it elsewhere is not permitted without explicit approval.