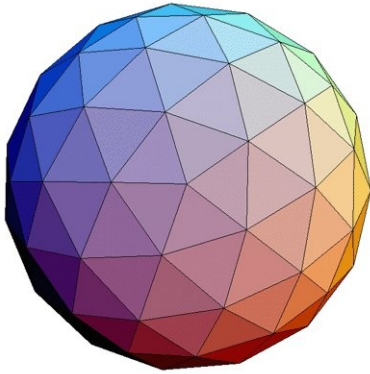


Introduction to Physics of Stars

Bonus problem (October 5st 2009)

In previous bonus problem we were trying to create an enclosed hollow sphere from set of thin and flexible surface permanent magnets. Pieces are connected together by sophisticated nano-manipulator that is able to join two pieces of magnet without any gap in between and also without disturbing magnetic domains around the junction. Therefore, resulting body should behave like monolithic magnet with spherical shape.



Is it possible to construct a sphere from the set of planes?

We can consider geodesic sphere consisting of the set of planar triangles. If you realize that our triangles are flexible and their edges are cut perpendicular to their surfaces, all pieces will slightly bend outside. At the end we will create perfect spherical surface.

It seems that nothing would prevent us to construct such object...

Nevertheless, in the real world we have to consider the Gauss law for magnetic fields:

$$\oiint \mathbf{B} \cdot d\mathbf{S} = 0$$

This equation has to be valid for all macroscopic physical bodies that involve magnetic fields. You can easily convince yourself that the sphere does not comply this equation. Basically, we found a way how to technically construct macroscopic magnetic monopole, a structure that can no way exist in our universe.

Previous problem has no solution because such sphere could not exist, despite of the fact that its construction seems technically feasible.

What would prevent us to construct such object? How would situation change, if we had not assumed stability of magnetic domains? Is there any parallel to solar magnetic field and cycles of solar activity?

To achieve a grade it is necessary to submit the solution till November 22nd, 5pm (exactly) to the office (06) 03041, or send it by e-mail to the address of T.A. (gszasz@physics.muni.cz).

Solution will be shown during the special lecture given in lecture room F4 on November 22nd at 6pm.

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