Experiment to Discover the Nature of Dark Matter

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Abstract

In this paper an experiment is proposed to establish the effect of the shape of matter on gravity.

Since Einstein we know that gravity is bended spacetime. Spacetime is a 4-dimensional constituent of the Universe. Spacetime has properties and behaviour of its own. Spacetime is bended by mass. So the question arises: how does mass bend spacetime? We can only learn about the gravitational properties of spacetime by deducing those properties from the behaviour of spacetime in nature, how spacetime behaves in space and time (our world of experience).

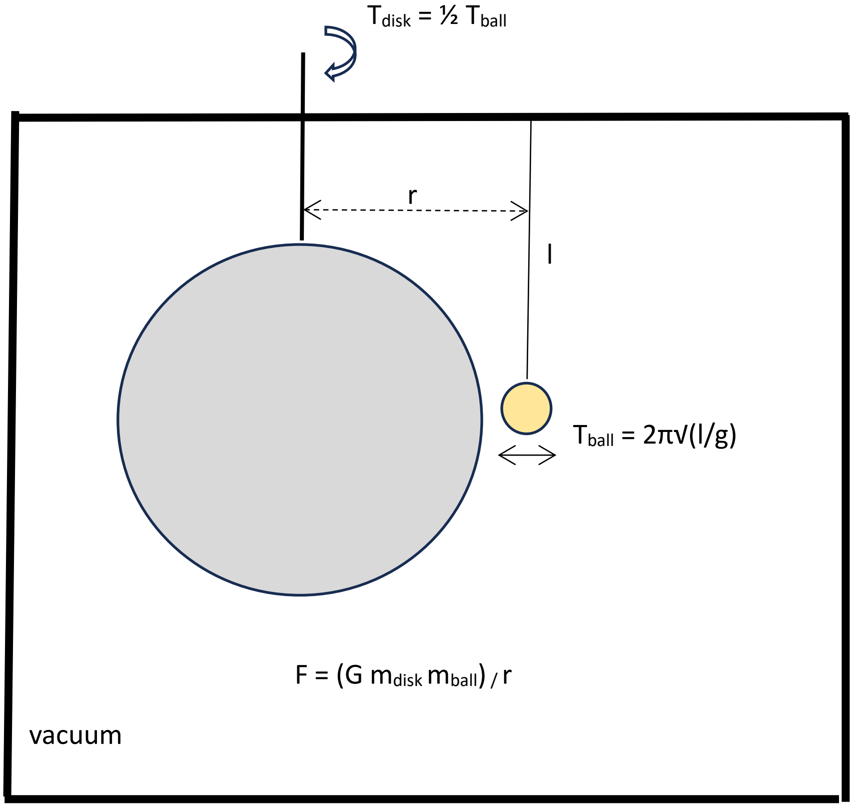
Gravitational fields propagate at the speed of light. So (bended) spacetime travels at the speed of light. Spherical masses bend spacetime equally in all directions. So spacetime moves at the speed of light in all directions.

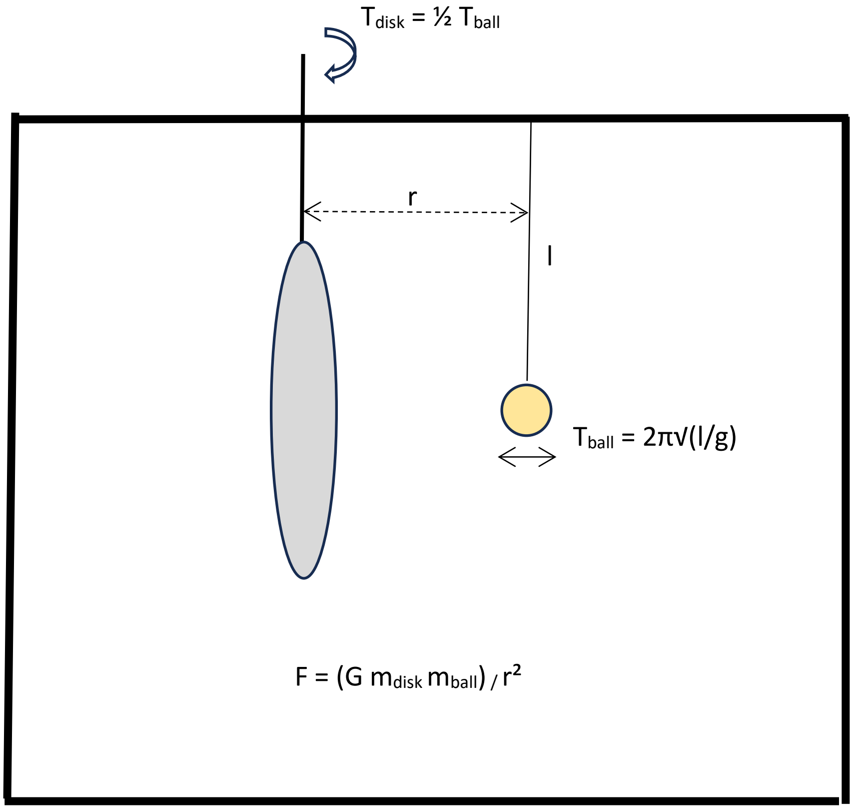
Suppose spacetime hits a spherical mass, creating a 'shadow' (like light) in all directions. This shadow would be the bended spacetime, the gravitational field. It is clear that the darkness of the shadow, the gravitational force field, depends on the amount of mass through which the spacetime has to travel.

Now consider a mass distribution in the shape of a disk (like a spiral galaxy). In a direction in the plane of the disk the spacetime has to pass through much more matter (mass) than in a direction perpendicular on the plane of the disk. The circumference of the disk depends on the radius (r) of the disk and widens proportional to r. That means that gravitational forces in directions in the plane of the disk, decrease inversely proportional to r. This is exactly what is measured in this kind of galaxies. If all the matter of the disk would be distributed spherically, then the gravitational force would be inversely proportional to r^2 (because the surface of a sphere increases with r^2). That is a much weaker force.

The proposal is to measure the difference between those forces experimentally. To establish this a very heavy disk is hanged on an axis. The disk rotates around the axis at an adjustable speed. Alongside the disk a small ball is hanged on a very flexible string. The ball must not be bigger than the thickness of the disk. To avoid electrical influences the ball must be made of a non-conductive material substance. To avoid air flow influences the experiment must be performed in vacuum conditions.

At a certain rotation speed the disk will exert a harmonic oscillating gravitational force (F) on the ball. The force will be maximal when the ball is in the plane of the disk and it will be minimal when the disk has rotated 90° in respect of that situation. At the right number of revolutions of the disk the oscillating force, exerted on the ball, will make the ball start to swing. The swing time (T) does not depend on the mass of the ball ($T = 2\pi\sqrt{(l/g)}$). In this formula l is the length of the string and g is the gravitational acceleration at the surface of the earth. The gravitational force on the ball, exerted by the disk varies between $F = (G\, m_{disk}\, m_{ball}) / r$ and $F = (G\, m_{disk}\, m_{ball}) / r^2$, in which G is the gravitational constant, m is the mass and r is the distance between the centre of the disk and the centre of the ball. Because G is very small the oscillating force is very weak and in the first revolutions it will cause an unperceivable amplitude. It is estimated that it takes 100 to 200 days to reach a perceivable amplitude (1-2 mm). So in this way the experiment is probably not feasible. Maybe interferometric technics can be helpful.





It is important to find out if and how gravity is influenced by the shape of matter. The proposed experiment is a theoretical simple way to find that out. If gravity behaves in the way that is described here, then we don't have to look for dark matter anymore.

If one massive object causes a gravitational field, this field has no effect. But as soon as another massive object approaches the first one, there is a gravitational force because in their common directions there is a spacetime shadow. In the opposite directions however, there is reflected spacetime causing a pressure force. So wherever there is a gravitational force between masses, there also is reflected spacetime in the opposite direction. This reflected spacetime from all masses in the Universe could very well explain the dark energy, the energy that causes the expanding of the Universe (in itself).