

# Laws for Gravity

*by*

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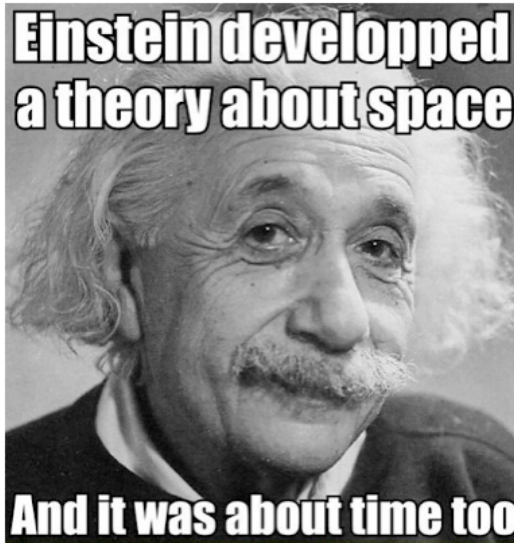
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**P3.6B** Predict how the gravitational force between objects changes when the distance between them changes.

**P3.6e** Draw arrows (vectors) to represent how the direction and magnitude of a force changes on an object in an elliptical orbit.

## Einstein and Nature of Gravity



A German Scientist

(1879-1955)

Einstein proposed that gravity is not a force, but an effect of space itself.

Einstein proposed that a mass changes the space around it and causes it to be curved. Therefore, when other moving masses pass close by, they follow this curvature and accelerate.

**Scientists are still searching to understand gravity.**

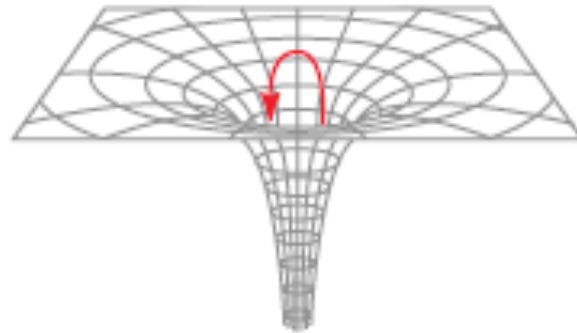
An experiment to picture this is shown in the figure below. In the picture, there is a two dimensional rubber sheet that represents the space. There are also two balls: a large yellow ball representing a massive object such as the sun and a small rolling gray ball representing a smaller moving object such as the Earth.



When the yellow ball (sun) was placed on the sheet (space), it curved it. So, the sun curved the space (sheet) around it and caused a little hole (curvature). The rolling gray marble represents the Earth. When the moving Earth passes close to the curvature of space made by the sun, it accelerates and follows an elliptical path.

## Example 2: *The Supermassive Black Holes:*

Black holes are present in space. They are massive, dense objects with immense gravity. The black hole matter is  $4.8 \times 10^{39}$  kg, which is equivalent to 2.4 billion of our sun ( $2.0 \times 10^9$  kg). They are located at the center of galaxy M87. They curve the space very deeply causing an immense gravity. No light ever escapes black holes. The immense gravity will totally bent back the light and return it.



## ***References:***

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2) Cutnell, J. D. & Johnson, K. W. (1998). *Cutnell & Johnson Physics, Fourth Edition*. New York: John Wiley & Sons, Inc.

*The edition was dedicated to the memory of Stella Kupferberg, Director of the Photo Department: “We miss you, Stella, and shall always remember that a well-chosen photograph should speak for itself, without the need for a lengthy explanation”*

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