

14900 Curvature of Space/Time



Purpose:

A framed oval of Spandex fabric, whose shape is distorted by positioned masses, serves to simulate the gravitational behavior of objects. This graphic representation of the fabric of space-time shows the effect of mass in Astronomy, Cosmology or Models of the Universe coursework.

Preparation:

The demonstration apparatus comes pre-assembled and ready for use. The spandex fabric is pre-stressed to provide the proper tension for demonstration of the space-time fabric concept. The hooked masses (provided) will cause the fabric to touch the table surface beneath the ellipse but the steel spheres will not.

Typical Demonstrations:

Placing the large steel ball alone in the center of the mounted fabric will distort the fabric to a shape that is useful for demonstrating the mutuality of gravitational attraction. In the demonstrations, collisions between balls are to be ignored. The demonstrator will attempt to send the small steel ball so that it will pass close to the large steel ball, but not hit it. It will be observed that the small ball will be greatly deviated towards the large one, but also that the large one will move noticeably towards the small one.

The gravitational attraction is mutual and equal between two bodies and varies inversely as the square of the distance between their centers of mass. The influence of this force on the motion of the bodies, however, varies inversely as their masses. The apparatus is intended to provide a qualitative display of these behaviors.

By placing one hooked mass in the center, the fabric will provide a plausible modeling of a Black Hole. In this case, collision is expected.

By placing the hooked masses at the foci of the elliptical shape, the small ball can be made to repeatedly orbit the two masses. These orbits will be observed to have a path like a figure-eight. Collisions are to be ignored here.

In the illustration, the small ball is seen at a natural LAGRANGE POINT, where the tendencies towards the large ball and towards the hooked mass are in balance. It may take several tries to experimentally find this position.

While the apparatus can be used for a simple single demonstration, it is quite suitable for individual student inquiry. In this case, video capture or other photography might easily lead to meaningful long term project work.

Time Allocation:

To prepare this product for an experimental trial should take less than two minutes. Actual experiments will vary with needs of students and the method of instruction, but the activities described are easily concluded within one class period.

Feedback:

If you have a question, a comment, or a suggestion that would improve this product, you may call our toll free number.