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Gravity via Art

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Short Communication

Behind the phenomenon of gravity exists the following story of the falling apple demonstrated in Figure 1 with the portrait of Sir Isaac Newton (1642-1727), mathematician and physicist, one of the foremost scientific intellects of all time. Newton was taking tea under the apple trees in the family gardens at Woolsthorpe-England one summer's afternoon in 1665 when an apple fell from an overhanging branch on the head, and immediately provided the inspiration for his law of gravitation. It may indeed have happened that way, but no one knows for certain. The story of Newton's apple first appears in Voltaire's Elements de la Philosophie de Newton, published in 1738, long after the great English mathematician had died and 73 years from the time the disputed apple fell. His only source for the apple story was Sir Isaac's niece Catherine Barton (1679-1739). She and her husband, who lived with and kept house for Newton in his declining years, believed Newton's story to be true. Another bit of evidence is Rev. William Stukeley's (1687-1765) biography of Newton written in 1752. Stukeley, a physician, cleric and prominent antiquarian, wrote that he was once enjoying afternoon tea with Sir Isaac amid the Woolsthorpe apple trees when the mathematician reminisced that "he was just in the same situation as, when, formerly, the notion of gravitation came into his mind".

Figure 1

In the following we concentrate on the physical aspects of gravity that is the force of attraction existing between every pair of objects in the universe. This force is proportional to the mass of each object in each pair, and inversely proportional to the square of the distance between the two. Interesting questions related to this force are: What causes objects to fall toward the earth? Why do the planets orbit the sun? What holds galaxies together? If you traveled to another planet, why would your weight change? All of these questions relate to one aspect of physics: gravity. For all of its influence on our daily lives, for all of its control over the cosmos, and for all of our ability to describe and model its effects, we do not understand the actual mechanisms of gravitational force. In other words, what is the reason for the formation of an attraction force between two masses? Moreover, of the four fundamental forces identified by physicists [1] - strong nuclear, electroweak, electrostatic, and gravitational - the gravitational force is the weakest of all forces. The history of modeling gravity begins with Galileo (1564-1642) who made careful observations of falling bodies. He demonstrated that all bodies fall at roughly the same rate. Kepler (1571-1630) proposed three laws governing how planets move around the Sun. It was Newton who on the basis of their observations and other scholars built his model on gravity. His idea was that gravity was a force that resulted from masses attracting each other. Einstein (1879-1955) refined Newton's concept of gravity by saying that large masses cause curving of space and consequently trajectories are created in which the smaller masses are moving. And finally it is interesting to note that in our day-to-day lives we can measure the force of gravity. Its most familiar term is 'weight'. Thus, in most cases, your measured weight is actually a measurement of the force of the Earth's gravity on you. The heavier you are, the greater is the force of gravity on you.

Having described the essentials of gravity, we will demonstrate in the following the phenomenon of gravity force by artworks. Figure 2 by an unknown photographer is a typical demonstration of falling bodies. However it is expected that at the final stage a parachute will be opened in order to slow down the falling velocity and land safely. Figure 3 is an artwork by an unknown artist of part of the solar system. The publishing company Dorling Kindersley installed it in the Internet. It demonstrates a stable solar system due to equilibrium between

Newton's universal law of gravity acting between two masses and the centrifugal force due to the circular flow of the different planets. According to Einstein's General Relativity gravity is a property of space where a body with a mass causes the curving of space. In such a space, which acts as an attraction force, bodies are moving in trajectories in which the resistance is minimal. Figure 4, an artwork by Victor Vasarely (1906-1997), Hungarian/French Abstract painter, demonstrates how a curved space looks like. The big mass of the apple creates the trajectory in which the small apple is moving. In addition the light beams in a white color are also curved. Figure 5 painted by Jim Warren demonstrates the case of small gravity so that the weight of the big man is low. This is the reason why the young child can hold him stably. Figures 6-8 demonstrates situations of the absence of gravity. Marc Chagall (1887-1985), a Russian/French artist, painted Figure 6 [2]. Figure 7 [3] is a surrealistic artwork of Rafal Olbinski (1945), a Polish poster designer and painter where Figure 8 [4] of people standing stably in the air was painted by Rene Magritte (1898-1967), a Belgium Surrealist.

Figure 2

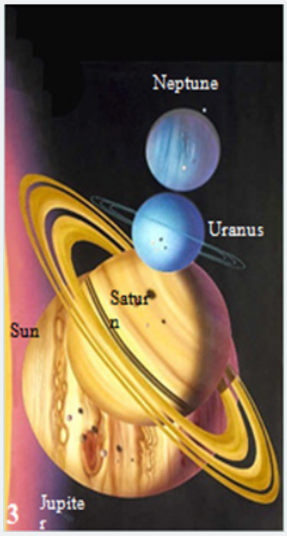

Figure 3

Figure 4

Figure 5

Figure 6

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Figure 7

Figure 8

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