Stanford eCorner

A Rubber Band Model Of the Universe

10-11-2008

URL: https://stvp.stanford.edu/blog/videos/a-rubber-band-model-of-the-universe

In this project, the student used rubber bands to construct a desktop model that illustrates the principles of Einstein's theory of special relativity. This rubber band desktop model is a fully self-contained model of a universe in which one can actually do experiments in special relativity.
One of the fundamental principles of modern science is that the speed of light is constant in every inertial frame of reference. In this rubber band model, I am able to demonstrate why this principle is true.
In this rubber band scale-model universe, all laws of physics are controlled by the Sine-Gordon equation, a single nonlinear partial differential equation that admits stable solutions that are known as solitons. By using these special solutions, I am able to construct measuring rods made out of kink solitons and clocks made out of breather solitons. If these solitons are then given a velocity, the kink measuring rods undergo length contractions and the breather clocks undergo time dilations.
As measured by rubber band people living in this universe who use these measuring tools, the speed of light in this universe is constant in every inertial system.
What is important about this rubber band desktop model universe is that we can do other experiments involving special relativity and that we can then extrapolate these results to our own real physical universe. In particular, this rubber band model universe shows why the speed of light in our own real universe is constant in every inertial system.

Transcript

English subtitles are not available for this media..