

In Search of the Dark Energy
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Cosmology is the study of the origin and fate of the universe. The Big Bang Theory is the prevailing cosmological model, which describes the early development of the Universe. It is very common for students to have difficulties in both qualitative and quantitative understanding of astronomical and cosmological concepts – a topic studied by educational researchers. Common difficulties students experience when learning cosmology, according to Wallace, Prather and Duncan (2012), are related to the naïve ideas about the expansion of the universe. For example, students think that only stars are moving away, the expansion of the cosmos increases with temperature, and the universe is shaped like an atom. In addition, they are struggling to read and interpret the Hubble plots. To begin address the misconception, a module to teach the expansion of the universe was created. This module is designed for high school classrooms and is aligned with the Next Generation Science Standards. The series of activities demonstrate two models for the expansion of the universe in two dimensions and time using balloons and rubber bands to simulate the fabric of space-time. This new module provides a rich, economical laboratory experience that teachers can implement in their classroom. The strongest part of the module is when students compare their graphs for the balloon and rubber band universes with the Hubble graphs. They calculate the slope to have the Hubble constant and to get the Hubble time using household materials. This result will lead them to compare the values of the Hubble constant and Hubble time for different acceleration models. This module can help them understand how the expansion of the universe is making the space bigger and moving galaxies farther apart, how the expansion is a cooling process and make them to consider dark energy as one of the causes. This will give them a stronger foundation in the expansion of the cosmos. Now the students are ready to discuss their results, make some research by their own, explain the Big Bang Theory better, are ready to learn and interpret other cosmology concepts.