

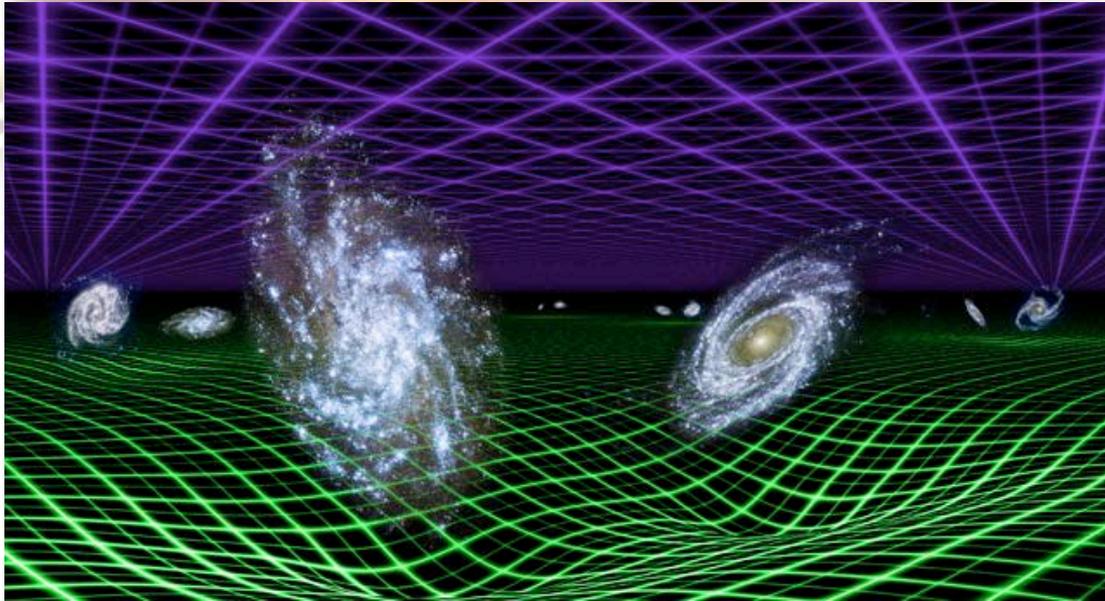
# **NASA SCIENCE HIGHLIGHT: Science Mission Directorate (SMD)**

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## **NASA Science Highlight: Planetary Program Support**

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## NASA's GALEX Telescope Confirms Nature of Dark Energy



In this artist's conception, dark energy is represented by the purple grid above, and gravity by the green grid below. Gravity emanates from all matter in the universe, but its effects are localized and drop off quickly over large distances.

It is commonly thought that the forces of both gravity and dark energy regulate the expansion of the universe. But new findings indicate that this mysterious dark energy is thought to be pushing the cosmos apart at faster and faster speeds, accelerating its expansion.

New results from NASA's Galaxy Evolution Explorer and the Anglo-Australian Telescope atop Siding Spring Mountain in Australia confirm that dark energy is a uniform force that is now dominating over the effects of gravity. The observations follow from careful measurements of the separations between pairs of galaxies. The results are the most revolutionary to date, in answering fundamental questions about the nature of dark energy.

## NASA's GALEX Telescope Confirms Nature of Dark Energy (Cont'd)

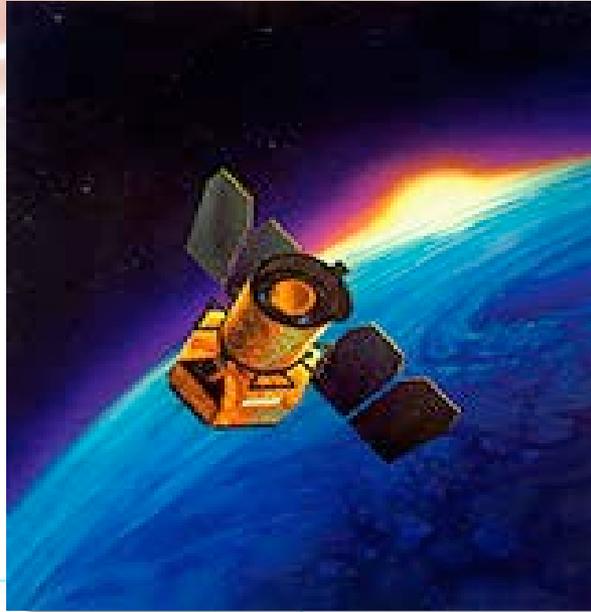


This diagram illustrates two ways to measure how fast the universe is expanding -- the "standard candle" method, which involves exploded stars in galaxies, and the "standard ruler" method, which involves pairs of galaxies. Image credit: NASA/JPL-Caltech

Data from NASA's space-based Galaxy Evolution Explorer and the Anglo-Australian Telescope on Siding Spring Mountain in Australia conducted a five-year survey of 200,000 galaxies, stretching back seven billion years in cosmic time. This is the first time astronomers performed these checks across the whole cosmic timespan dominated by dark energy. The team began by assembling the largest three-dimensional map of galaxies in the distant universe, spotted by the Galaxy Evolution Explorer. The astronomers acquired detailed information about the light for each galaxy using the Anglo-Australian Telescope and studied the pattern of distance between them. Sound waves from the very early universe left imprints in the patterns of galaxies, causing pairs of galaxies to be separated by approximately 500 million light-years. They found that dark energy acts as a constant force, uniformly affecting the universe and propelling its runaway expansion. They contradict an alternate theory, where gravity, not dark energy, is the force pushing space apart.

Dark energy is thought to dominate our universe, making up about 74 percent of it. Dark matter, a slightly less mysterious substance, accounts for 22 percent. So-called normal matter makes up only approximately four percent of the cosmos. The idea of dark energy was proposed during the previous decade, based on studies of distant exploding stars called supernovae. Supernovae emit constant, measurable light, making them so-called "standard candles," which allows calculation of their distance from Earth. Observations revealed dark energy was flinging the objects out at accelerating speeds.

## NASA's GALEX Telescope Confirms Nature of Dark Energy (Cont'd)



### **Implications:**

Dark energy is in a tug-of-war with gravity. In the early universe, gravity took the lead, dominating dark energy. Then, at about 8 billion years after the Big Bang, as space expanded and matter became diluted, gravitational attractions weakened and dark energy gained the upper hand, changing the way astronomers observed motion throughout the Universe.

### **Significance to Solar System Exploration:**

Billions of years from now, dark energy may even more dominant. Astronomers predict our universe will be a cosmic wasteland, with galaxies spread apart so far that any intelligent beings living inside them wouldn't be able to see other galaxies.