

Prometheus Unwound

A Composition by Larry Groupé

Narration by Evan Kirby

Performed at Palomar Observatory on August 20, 2016

Luminescence

All cosmic objects glow. By virtue of their internal heat, by virtue of electrons swirling around them, or by the vagaries of quantum mechanics, every object in the Universe—even a black hole—emits light. We cannot always see this light because it arrives in the form of infrared radiation or perhaps radio waves or even X-rays. Nonetheless, everything is luminescent. Even the musicians before you and their instruments are glowing in infrared light, but your eyes cannot see it. Rely, then, on your ears. As you hear the sound waves coming from each string, consider that they are also aglow in invisible light waves.

Dark Matter

The Universe is awash in an unknown substance. You cannot see it. You cannot feel it. Yet it is there. We know it is there because it is tugging on each and every star and galaxy. Collectively, dark matter outweighs every other kind of matter fivefold. At this moment, dark matter is hurtling through this telescope, through the air, and through your bodies. By the time you hear the notes from these strings, microscopic dark matter particles have passed through them and struck you at a speed of hundreds of miles per second. Be thankful then, that dark matter cannot be felt. But also be thankful that it is there. Without it, our galaxy would not have formed. Without it, we would not be here. Over the history of time, the Universe has formed a web of dark matter, where galaxies are connected by gossamer threads. We live at the intersection of some of these threads. Again, we cannot see dark matter. So I leave it to your imagination to picture this mysterious network that grants us our very existence.

Redshift

Stars and galaxies are all in motion relative to each other. Galaxies are pushed apart and away from each other by the expansion of the Universe. As light escapes these galaxies, it travels through the ever-expanding Universe. The very stretching of space changes the energy of the light, stretching the light waves, forcing them to be redder. The sensitive detectors in this cage at the bottom of the Hale telescope can measure exactly how fast the galaxies are receding from us by measuring the redshift of their light. Some of the first observations through the Hale telescope were the redshifts of galaxies measured by Allan Sandage and Edwin Hubble. Some of those same galaxies are overhead now. Since their light first glanced off this giant mirror, they have moved tens of light years farther away, their light being stretched and redshifted even further. Every moment, they move away faster and faster, careening toward an unsettling oblivion, where every galaxy is alone, unimaginably far from every other galaxy.

Resonance

The Sun dominates the solar system. Its gravity dictates the motions of all of the planets, comets, and most of the asteroids. However, these objects can also affect each other. Occasionally, an asteroid in orbit around the sun passes close to the Earth, and its orbit becomes deflected by the Earth's gravity. Even the larger bodies of the solar system can be affected by each other. Pluto and Neptune are locked in a resonance. For every three orbits of Neptune around the sun, Pluto orbits the sun twice. The moon itself is locked to the gravity of the Earth. The moon spins exactly once for every orbit around the Earth, causing us to see only one side of it. Resonance is a phenomenon ubiquitous in physics and in human nature. Bowing one string on the cello causes the others to resonate with it. The strings respond to each other, moving in synchrony. Perhaps you feel the same about the person sitting next to you. As you act, they react in synchrony, in harmony. As you observe and listen to these musicians, ask yourself: What resonates with you?