New telescopes to give researchers glimpse of the beginning of time
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Professor Adrian Lee of UC Berkeley.

Fluctuations in space-time, also known as "gravitational waves," are gravitational perturbations that propagate at the speed of light and can penetrate "through" matter, like an x-ray. The gravitational waves are thought to have imprinted the "primordial soup" of matter and photons that later coalesced to become gases, stars and galaxies—all the structures that we now see. The photons left over from the Big Bang will be captured by the telescopes to give scientists a unique view back to the universe's beginning.

The telescopes of the Simons Array—named in recognition of the grant—will focus light onto more than 20,000 detectors, each of which must be cooled nearly to absolute zero. The result will provide an unmatched combination of sensitivity, frequency coverage and sky coverage.

Last year, the first POLARBEAR (for Polarization of Background Radiation) telescope, which will comprise one third of the Simons Array, was set up in Chile's Atacama Desert. The site is one of the highest and driest places on Earth at 17,000 feet above sea level, making it one of the planet's best locations for such a study. The site's high elevation means that it lies above half of the Earth's atmosphere. Because water vapor absorbs microwaves, the dry climate allows the already thin atmosphere to transmit even more of the faint cosmic microwave background radiation. Since March 2012, the telescope has recorded data to identify an imprint of primordial gravitational waves on the cosmic microwave background radiation, the relic radiation remaining from the Big Bang.

While POLARBEAR was a major technological achievement, the single telescope is sensitive to just one frequency. Additional detectors in the new telescopes will measure the cosmic microwave background at different frequencies so that researchers can compare the data and subtract out...
contaminating radiation emitted from the Milky Way Galaxy. Together, the three telescopes will also be much more sensitive to the elusive gravitational wave signals, offering deeper insight into the origin of the universe.

Keating continued, "The Simons Array will have the same or better capabilities as a $1 billion satellite, and with NASA's budget constraints, there are no planned space-based missions for this job."

Scientists from UC San Diego, UC Berkeley, Lawrence Berkeley National Laboratory, University of Colorado, McGill University in Canada and the KEK Laboratory in Japan are collaborating on the project.

For more information on the Simons Array, visit cosmology.ucsd.edu. More information on the Simons Foundation can be found at simonsfoundation.org.