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The Future of Cosmology

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Remarkable progress has been made in precision cosmology since the pioneering choices laid out a century ago by Lemaître, yet we are currently at a turning point. Experiments have become so large and expensive that we need to prioritize where to go next for compelling and guaranteed science return that is significantly beyond current limits in cosmology. The lunar surface allows a unique way forward. The far side provides a unique radio-quiet environment for exploring the ultimate frontier in observational surveys of the Universe, the dark ages, via 21 cm interferometry and to seek elusive clues on the nature of cosmic inflation. Permanently cold and dark polar craters will provide potential sites for far infrared telescopes that will use the spectrum of the cosmic microwave background radiation to probe our cosmic origins in the first months of cosmic time. Optical and infrared interferometers operating at unprecedented resolution and sensitivity will address profound questions currently being raised about the most distant galaxies and massive black holes, and explore biological tracers in large numbers of exoplanet atmospheres in order to pose the ultimate question of whether we are alone in the Universe.

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