

Investigating the expansion of the Universe



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Charlie Baltay explores fundamental issues in particle physics, astrophysics, and cosmology. His research focuses on the nature of dark energy, a mysterious component that makes up three quarters of our universe that we know essentially nothing about. The Baltay group investigates dark energy via the study of distant supernova explosion events both from ground-based telescopes in the Andes Mountains in Chile and from the Nancy Grace Roman Space Telescope (formerly known as WFIRST).



LaSilla/QUEST Southern Hemisphere survey

Because the Hubble constant appears to be changing, scientists now theorize that the Universe is expanding and that there must be a new form of energy in the Universe, which scientists call dark energy. The Baltay group is working to resolve unexplained discrepancies in Hubble constant measurements using both Type Ia supernovae and RR Lyra variables as “standard candles” to calibrate measurements.

The Baltay group’s work has improved the precision of the Hubble constant measurement such that it is now better than the discrepancy. Furthermore, the group, including researchers from Yale Astronomy Department, has been able to detect traces of structure in the Milky Way galaxy that will lead to greater understanding of the history of the formation of the galaxy,

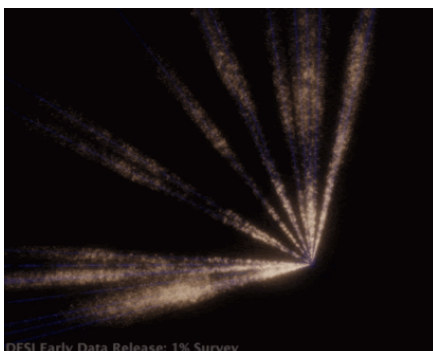


A new international collaboration, including the Baltay group, has assembled to execute a new five-year survey called La Silla Schmidt Southern Survey (LS4). The Baltay group will contribute to the upgrade of the Quasar Equatorial Survey Team (QUEST) camera—originally built at Yale and Indiana University and installed on the one-meter Schmidt Telescope in Chile—for LS4. QUEST will be optimized to follow up on transient objects that might be discovered in surveys conducted by larger telescopes, such as the Legacy Survey of Space and Time (LSST) at Rubin Observatory in Chile.



Nancy Grace Roman Space Telescope mission

Baltay and his collaborator Saul Perlmutter (U.C. Berkeley) have advised NASA for many years on the design and use of the Roman Space Telescope for a supernova survey that, when combined with data from Baltay’s southern hemisphere surveys, will provide important new information about the nature of the mysterious acceleration of the expansion of our universe and dark energy. Baltay will continue efforts to develop the survey in 2024. The telescope is expected to launch in 2026.



Yale Fiberview Camera

The Dark Energy Spectroscopic Instrument (DESI) on the Mayall telescope at Kitt Peak National Observatory in Arizona is designed to create a 3-D map of the sky that will allow researchers to measure the effects of dark energy on the expansion of the universe. The Yale Fiberview Camera—designed, built, and installed by the Baltay group at Wright Lab—is an integral part of the efficiency and precision of DESI. DESI recently released eight terabytes of data that includes nearly two million objects. The data has already led to a set of published papers that demonstrate DESI’s ability to accomplish its design goals.