The After Sloan 3 (AS3) project will make important contributions to fundamental physics from a better understanding of the nature of the accelerated expansion of the Universe and dark energy, to constraining the physics of inflation, to measurements of neutrino masses.

One of the most important questions in modern physics is to understand the accelerated expansion of the Universe, the discovery of which won the Nobel Prize in Physics in 2011. A key goals of the AS3 project is to map the history of theis accelerated expansion via the imprint of “sound” waves frozen into the distribution of galaxies – so-called Baryon Acoustic Oscillations (BAO). The BAO method is acknowledged to be the most robust probe of this expansion history, and the AS3 project will extend these measurements further back in time and with higher precision. These same measurements of the distribution of galaxies also will test whether this acceleration is due to an as-yet undiscovered new component of the Universe or a breakdown of Einstein’s theory of gravity on cosmological scales – either of which would have profound implications for our view of physics.

The key measurement that makes the above possible is a large survey of the positions of galaxies. By studying this distribution of galaxies, AS3 will also place important constraints on the physics of inflation – the process that laid down the initial conditions of the Universe. These patterns in the clustering of galaxies also carry information about the masses of neutrinos, competitive with the state-of-the-art experiments possible from the ground.