

NWS05-2005-000011

Abstract for an Invited Paper
for the NWS05 Meeting of
the American Physical Society

Precision Cosmology with Weak Gravitational Lensing

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The deflection of photons by massive structures in the universe gives rise to a small, but measurable net alignment in the shapes of distant galaxies. The measurement of this “weak gravitational lensing” effect enables us to study the dark matter distribution in the universe directly, making it a powerful tool for observational cosmology. By itself, or in combination with other methods, such as CMB, weak lensing provides tight constraints on a range of cosmological parameters. This relatively new area of research has developed quickly in the past few years, and the prospects for the future are excellent. Several large surveys are underway or being planned with the aim to provide unique, tight constraints on the properties of the dark energy and dark matter. In this talk I will discuss the theory and how the measurements are made. I will review recent progress in this rapidly evolving field, and demonstrate its potential through some interesting applications.