APR09-2009-000236

Abstract for an Invited Paper
for the APR09 Meeting of
the American Physical Society

A Redetermination of the Hubble Constant with the Hubble Space Telescope from a Differential Distance Ladder

ADAM RIESS, JHU/STScI

We report results from a program to determine the Hubble constant to $\sim 5\%$ precision from a refurbished distance ladder based on extensive use of differential measurements. The measurement makes use of 240 Cepheid variables observed with the Near Infrared Camera and Multi-Object Spectrometer (NICMOS) on the *Hubble Space Telescope (HST)*. The Cepheids are distributed across six recent hosts of Type Ia supernovae (SNe Ia) and the "maser galaxy" NGC 4258, allowing us to *directly* calibrate the peak luminosities of the SNe Ia from the precise, geometric distance measurements provided by the masers. The homogeneity of the Cepheid periods and metallicities provided and our dependence on purely *differential* Cepheid fluxes enabled by the use of the same instruments for all Cepheid measurements reduces the largest systematic uncertainties in the determination of the fiducial SN Ia luminosity. In addition, the NICMOS measurements reduce the effects of differential extinction in the host galaxies by a factor of $\sim$5 over past optical data. Using the flux-redshift relation of SNe Ia, we have measured H_0 with 4.7% uncertainty including both statistical and systematic errors. We show that the factor of 2.2 improvement in the precision of H_0 is a significant aid to the determination of the equation-of-state parameter of dark energy, $w = P/(\rho c^2)$. Combined with the Wilkinson Microwave Anisotropy Probe 5-year measurements of $\Omega_M h^2$, we find $w = -1.12 \pm 0.12$, a result independent of high-redshift SNe Ia and baryon acoustic oscillations (BAO), though consistent with their combination. The constraints on $w(z)$ now including high-redshift SNe Ia and BAO are consistent with a cosmological constant and are improved by a factor of 3 due to the refinement in H_0 alone. We show that future improvements in the measurement of H_0 are likely and should further contribute to multi-technique studies of dark energy.