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Destiny, The Dark Energy Space Telescope

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Destiny is a simple, direct, low cost mission to determine the properties of dark energy by obtaining a cosmologically deep supernova (SN) type Ia Hubble diagram. Operated at L2, its science instrument is a 1.65m space telescope, featuring a grism-fed near-infrared (NIR) ($0.85 - 1.7\mu m$) survey camera/spectrometer with a 0.12 square degree field of view. During its two-year primary mission, Destiny will detect, observe, and characterize ~ 3000 SN Ia events over the redshift interval $0.4 < z < 1.7$ within a 3 square degree survey area. In conjunction with ongoing ground-based SN Ia surveys for $z < 0.8$, Destiny mission data will be used to construct a high-precision Hubble diagram and thereby constrain the dark energy equation of state from a time when it was strongly matter-dominated to the present when dark energy dominates. The grism-images simultaneously provide broad-band photometry, redshifts, and SN classification, as well as time-resolved diagnostic data for investigating additional SN luminosity diagnostics. Destiny will be used in its third year as a high resolution, wide-field imager to conduct a multicolor NIR weak lensing (WL) survey covering 1000 square degrees. The large-scale mass power spectrum derived from weak lensing distortions of field galaxies as a function of redshift will provide independent and complementary constraints on the dark energy equation of state. The combination of SN and WL is much more powerful than either technique on its own. Used together, these surveys will have more than an order of magnitude greater sensitivity than will be provided by ongoing ground-based projects. The dark energy parameters, w_0 and w_a, will be measured to a precision of 0.05 and 0.2 respectively.