# Cosmological Constraints from Measurements of Type Ia Supernovae discovered during the first 1.5 years of the Pan-STARRS1 Survey

**Sample and cuts:**

* 310 SNe Ia used for cosmological analysis
  + Pan-STARRS1 (PS1) sample: 146 SNe Ia in the redshift range 0.03<z<0.65, where 113 passed quality cuts
  + Low-z sample (lz): 222 light curves from 197 low-z SNe Ia passed quality cuts; compiled from various other surveys

**Light curve fits to luminosity distance measurements:**

* Used SALT2 as light curve fitter
* Transformed light curve fit parameter into distances using (SALT2mu)
  + : distance modulus
  + : peak B-band brightness
  + : light curve shape parameter
  + : color parameter
  + , , : nuisance parameters
    - : relation between L and stretch
    - : relation between L and color
    - : absolute B-band magnitude where ==0
* Error of each SN distance: photometric errors, intrinsic scatter, and redshift uncertainty added in quadratures
  + Intrinsic scatter and photometric errors include dependence on nuisance parameters and covariances between fit parameters
* SALT2mu propagates these errors and finds and that minimize distance modulus residuals for a given cosmology
* Cosmological constraints found from SN sample with only stat errors by measuring value for a grid of vs with and vs vs for flat universe

**Systematic Uncertainties:**

* Total uncertainty matrix
  + : diagonal only, errors from fit parameters and intrinsic scatter
  + : calculate by varying an uncertainty parameter, find difference between original and new distance
  + Distance modulus residuals of SN sample
  + where

**Constraints from other probes:**

* Used Planck Collab et al 2013 to include CMB, BAO constraints (used their Markov Chains for determining cosmological parameters)
  + Flat wCDM: used Planck’s +w model
  + Non-flat ΛCDM model: used Planck’s +k model
  + CMB: used Planck’s data with temp power spectrum, lensing, polariz, etc
* Used Riess et al 2011 for Hubble constraint

**Important results and plots:**







