Refine this point, and make it based on arguments of continuity with the lower redshift SNe.

extinction is not directly treated as a statistical error.

5.4. K-corrections and Supernova Colors

The generation of the spectral template used for calculating K-corrections is described in § 2.3. The degree to which uncertainties in the K-correction introduce systematic uncertainties into the cosmological parameters depends on whether or not extinction corrections are being individually applied to supernovae. In particular, our K-corrections are most uncertain in the rest-frame U-band range of the supernova spectrum, due to limited published spectrophotmetry. As discussed in § 2.2, our primary fits use a spectral template which has a color U-B= 0.4 at the epoch of B-maximum. We have investigated the effects on our cosmology of replacing the spectral templates used both for K-corrections and for determining color excesses with a template that has U-B= 0.5 at the epoch of maximum B light.

Figure 5c shows affect on the fitted cosmology caused by using the different template for calculating K-corrections when individual host-galaxy extinction corrections are not applied. These effects are very mild, indicating that our K-corrections are robust with respect to the intrinsic U-B color of a supernova. Based on the comparison of these fits, we adopt a K-correcton systematic uncertainty of 0.01 on Ω_M in a flat universe, 0.13 on $\Omega_M + \Omega_\Lambda$, and 0.10 in w.

Although the effects of a different intrinsic U-B color on the K-corrections are mild, the effects on calculated color excesses are much greater. Figure 5d shows the difference between Fit 6, where host-galaxy extinction corrections have been applied using our standard color-excess values, and a fit where color-excess values have been determined assuming the intrinsic U-B color of a supernova is 0.5 at maximum light. As with all other systematics, the primary effect is to move the confidence intervals along their major axis. In this case, the large shift in $\Omega_M + \Omega_\Lambda$ is mainly due to the fact that with this bluer assumption amout U-B, we would believe that all of our $z > 0.7$ supernovae are suffering from a significant about of host-galaxy extinction, and as such all need to be dereddened. Given that the more distant supernovae are dimmer and thus closer to our detection limits than the moderate redshift supernovae, this scenario is implausible. If anything, one would expect the higher redshift supernovae to be *less* subject to host-galaxy extinction due to selection effects. Nonetheless, a value of U-B= 0.5 at the epoch of B-band maximum is currently plausible given the U-band information available. Only for those fits where extinction corrections are applied, we have an additional intrinsic U-B systematic error of 0.06 on the flat-universe value of Ω_M, and a systematic error of 2.5 on $\Omega_M + \Omega_\Lambda$. That it is implausible that our highest redshift supernovae are the most extinguished makes it likely that this is an overestimate of this systematic.

The systematic effect of changing the assumed intrinsic color is not as significant on the flat-universe value of w as it is on the $w = 0$ value of $\Omega_M + \Omega_\Lambda$. When combined with the CMB/large scale structure mass measurement, the best-fit value of w is only 0.05 higher than the value from our primary extinction-corrected fit. We adopt this difference as our systematic uncertainty on w when host-galaxy extinction corrections are applied.

5.5. Malmquist Bias

As most of our supernovae are from flux-limited samples, they will suffer Malmquist bias (Malmquist 1924, 1936). This effect was discussed extensively in P99, and here we update that discussion to include our new HST SNe Ia. For the measurement of the cosmological parameters, it is the difference between the Malmquist bias of the low-redshift and high-redshift samples which matters. In particular, the probability of $\Omega_\Lambda > 0$ is enhanced only if the low-redshift SNe suffer more Malmquist bias than the high-redshift SNe, as this makes the high-redshift SNe Ia seem fainter.

The P99 high-redshift dataset was estimated to have little Malmquist bias (0.01 mag) because the SN discovery magnitudes were decorrelated with the measured peak magnitudes. However, for the new HST sample, nine of the eleven SNe Ia selected from full search samples were found almost exactly at maximum light. This may reflect a spectroscopic flux limit superimposed on the original search flux limit since only spectroscopically confirmed SNe Ia were considered, and of those, generally the higher redshift SNe Ia from a given search were chosen, for HST for follow-up. In particular, the SNe Ia selected for follow-up from the

[[delete comma]]

fall 1997 search were all found at maximum light, while all but SN 1998aw from the spring 1998 search were found at maximum light. SN 2000fr was found well before maximum. Thus, the new dataset is likely to suffer more Malmquist bias than the P99 dataset. Further complicating the interpretation for the high-redshift SNe is the fact that our new HST SNe are spread over a wide range in redshift, such that a single brightness correction for Malmquist bias causes a more complicated change in the fitted cosmological parameters. This is unlike the situation in P99 in which most SNe were at $z \sim 0.5$. Following the calculation in P99 for a high-redshift flux-limited SN sample we estimate that the maximum Malmquist bias for the ensemble of HST SNe is ~ 0.03 mag. However, we caution that it is SNe near the flux-limit which are most strongly biased, and therefore, that a subsample comprised of the highest redshift members drawn from a larger flux-limited sample will be more biased. When combined with the P99 high-redshift SNe, the bias is likely to be ~ 0.02 mag since both samples have roughly the same statistical weight.

As for the low-redshift SNe Ia, in P99 we established that since most of the SNe Ia from the H96 flux-limited search were found near maximum, that sample suffered about 0.04 mag of Malmquist bias. On the other hand, the R99 SNe Ia were discovered using a galaxy-targeted technique, which therefore is not limited by the SN flux, and may be more akin to a volume-limited sample (Li, Filippenko, & Riess 2001). Thus, the addition of the R99 SNe Ia could slightly reduce the overall Malmquist bias of the low-redshift sample. If we were to assume no Malmquist bias for the R99 SNe Ia, and allowing for the fact that they contribute only $\sim 1/3$ the statistical weight of the H96 SNe, we estimate that the Malmquist bias in the current low-redshift sample is roughly 0.03 mag.

Since Malmquist bias results in the selection of overly-bright SNe at the limits of a flux-limit survey, and since the flux-limit can be strongly correlated with redshift[26], this bias can result in an apparent distortion of the shape of the Hubble diagram. This may affect estimates of the dark energy equation of state. The selection effects for the current high-redshift SNe are not sufficiently well-defined, nor are the constraints on the dark energy equation of state sufficiently strong, to warrant modeling of this effect with the current datasets. However, for future work, much better control of the selection criteria for SNe Ia at both low- and high-redshift will be required in order to properly estimate the impact of this small, but nearly inescapable, bias.

In the mean time, we simply note that since the *differences* in the Malmquist biases of the high- and low-redshift subsets of SN are likely to be *smaller* in this work than in P99, we are less likely to be affected by Malmquist bias than that work. Given that the new HST high-redshift SNe sample suffers more Malmquist bias than the P99 sample, and that the enlarged low-redshift sample is likely to have less Malmquist bias than the low-redshift sample used in P99, the overall bias towards apparently fainter SNe Ia at high-redshift should be less than in P99. In particular, the sign of the bias is working to artificially decrease the statistically infered $P(\Omega_\Lambda > 0)$. Thus, if anything, the Malmquist bias in the present sample works to enhance confidence in the confirmation of an accelerating Universe presented in this paper. In addition, since the intrinsic dispersion decreases from ~ 0.17 mag to ~ 0.10 mag after extinction correction, the Malmquist bias in the extinction corrected fits is almost halved.

5.6. Dust Evolution

Possible evolution in the extinction properties of host-galaxy dust is a source of systematic error in our measurement. To examine the size of the effect, we consider an extreme situation where dust in $z < 0.3$ spiral galaxies have a Cardelli, Clayton, & Mathas (1989) $R_V = 3.1$ law whereas higher-redshift galaxy dust have $R_V = 1.505$. We use the Monte Carlo described in Kim *et al.* (2003) to study the bias induced when an $R_V = 3.1$ extinction correction is unappropriately applied to all supernovae. We incorperate the redshift and $E(B\text{-}V)$ distributions of the supernovae considered in this paper and an $E(B\text{-}V) < 0.1$ cut is applied. For an input cosmology of $\Omega_M = 0.3$ and $\Omega_\Lambda = 0.7$, we find a modest shift in the cosmological parameters to $\Omega_M = 0.34$ and $\Omega_\Lambda = 0.67$ without assuming a flat universe.

This bias moves almost exactly along the line

[26] They are 100% correlated for a single field, but this correlation can be diluted by combining fields of different depths.

[Could we get Alex Kim to run this Monte Carlo for an input cosmology of Omega_M = 0.2 and Omega_Lambda = 0.8 instead, so that we get a result closer to the current best fit numbers of this paper?]

$\Omega_M + \Omega_\Lambda = 1$, increasing uncertainty along the thin axis of the error contour, and hence also in the deceleration parameter. However, the extreme difference in dust properties considered in the Monte Carlo contributes a shift in the cosmological parameters that is less than 1 σ of our quoted statistical error bars. We adopt 0.04 as the dust evolution systematic uncertainty on $\Omega_{\rm M}$ in a flat universe for those fits where host galaxy exctinction corrections are applied, with the understanding that this is from the extreme case noted above; this sytematic is insignificant along the major axis of the confidence ellipses.

one particular

5.7. Gravitational Lensing

Gravitational lensing decreases the modal brightness and causes increased dispersion in the Hubble diagram for high redshift SNe. These effects have been discussed in some detail in the literature (Wambsganss *et al.* 1997; Frieman, J. A. 1997; Holz 1998; Kantowski 1998; Seljak & Holz 1999; Metcalf & Silk 1999; Metcalf 1999; Holz 2001; Wang, Holz, & Munshi 2002; Minty, Heavens, & Hawkins 2002; Ammanullah, Mörtsell & Goobar 2003; Dalal, Holz, Chen, & Frieman 2003; Oguri, Suto, & Turner 2003), especially in relation to the R98 and P99 SN datasets. A very conservative assumption of an "empty beam" model in a universe filled with compact objects allowed P99 to demonstrate that gravitational lensing does not alter the case for dark energy. Gravitation lensing may result in a biased determination of the cosmological parameter determination, as discussed in Ammanullah, Mörtsell & Goobar (2003). The size of the effect depends on the fraction of compact objects of the total mass density of the universe, $\Omega_{\rm M}$.

[Switch the order of these two citations.]

The potential bias increases with the redshift of the SNe in the sample. E.g. for the most distant known Type Ia SN, SN1997ff at z=1.7, there is evidence for significant magnification, $\Delta m \sim 0.3$ (Lewis & Ibata 2001; Mörtsell, Gunnarsson & Goobar 2001; Benitez et al. 2002).

As the SN sample considered in this paper does not reach as far, the (de)magnification distortions are expected to be small, in general below 0.05 mag. To estimate the systematic uncertainties in the cosmological parameters we have used the SNOC package (Goobar et al 2001) to simulate 100 realizations of our data sets assuming a 20 % universal fraction of Ω_M in compact objects, i.e. of the same order as the halo fraction deduced for the Milky Way from microlensing along the line of sight to the Large Magellanic Cloud (Alcock et al. 2000). The light beams are otherwise assumed to travel through space randomly filled with galaxy halos with mass density with equaly divided into SIS and NFW profiles, as described in (Bergström et al 2000). According to our simulations we find that (for a flat universe), on average, the fitted value of Ω_M is systematically shifted as $\delta = < \Omega_M^{true} - \Omega_M^{fit} > = 0.01$, with a statistical dispersion $\sigma_\delta = 0.01$. We adpot 0.01 as our gravitational lensing systematic error in the flat-universe value of $\Omega_{\rm M}$. ARIEL, DO YOU HAVE A NUMBER FOR $\Omega_{\rm M}+\Omega_\Lambda$ HOW ABOUT W IN A FLAT UNIVERSE?

by 0.01 on average,

and less than 1% for the cases considered in P99. [We should put some words in like this to tie this discussion to our P99 discussion.

5.8. Supernova Population Drift

In P99 we discussed in detail whether the high-redshift SNe Ia could have systematically different properties than low-redshift SNe Ia, and in particular, whether intrinsic differences might remain after correction for stretch. One might imagine this to occur if the range of the physical parameters controlling SN Ia brightnesses have little overlap between low- and high-redshift such that corrections applied to low-redshift are inappropriate or incomplete for high-redshift SNe Ia. Since P99, considerable additional work as been done to address this issue, which we now discuss.

First, several tests performed directly with the P99 sample of high-redshift SNe Ia (in addition to the comparisons of stretch range, and spectral (Perlmutter *et al.* 1998) and lightcurve (Goldhaber *et al.* 2001) features already discussed in P99) have shown excellent consistancy with expectations from low-redshift SNe Ia. Most recently, Sullivan *et al.* (2003) have presented results on the Hubble diagram of distant Type Ia supernovae from P99 which have been morphologically-typed with HST. They find no difference in the cosmological results from their morphologically-segragated subsamples. In particular, E/S0 galaxies — for which one expects the tightest possible correlation between progenitor mass and redshift — not only agree with the cosmological fits using only spiral galaxies, but by themselves confirm the results of P99. This is strong evidence that, while age or metallicity could in priciple af-

re-word

in / we / that / We found

fect the brightnesses of SNe Ia, stretch correction eliminates these differences. Likewise, the lightcurve rise-time — suggested as an indicator of the energetics of the SN explosion (see Nugent *et al.* (1995); Hoflich, Wheeler, & Thielemann (1998) — while initially claimed to be different between high- and low-redshift SNe Ia (Riess, Filippenko, Li, & Schmidt 1999), has demonstrated very good agreement (within 1.8 ± 1.2 days; Aldering, Knop, & Nugent (2000)). On the theoretical side, the SN formation models of Kobayashi et al. (1998); Nomoto, Nakamura, & Kobayashi (1999) suggest that the progenitor binary system must have [Fe/H]$>$ 1 in order to produce a SN Ia. This would impose a lower limit to the metallicities of all SNe Ia, and thus limit the extent of any metallicity-induced brightness differences between high- and low-redshift SNe Ia. At low-redshift, several studies have presented data suggesting that SNe Ia intrinsic luminosities (i.e., those prior to stretch correction) may correlate with host-galaxy environment (Hamuy *et al.* 1996b; Branch, Romanishin, & Baron 1996; Wang, Hoeflich, & Wheeler 1997; Hamuy *et al.* 2000; Ivanov, Hamuy, & Pinto 2000; Howell 2001; Wang *et al.* 2003, R99). These findings are actually encouraging, since unlike stretch itself, there is some hope that host-galaxy environment variations can be translated into the types of physical parameters such as age and metallicity which can help in relating any drifts in the SNe Ia population to galaxy evolution. Indeed, the lack of a gradient in the intrinsic luminosities of SNe Ia with galactocentric distance, coupled with the fact that metallicity gradients are common in spiral galaxies (Henry & Worthey 1999), lead Ivanov, Hamuy, & Pinto (2000) to suggest that metallicity is not a key parameter in controlling SNe Ia brightnesses at optical wavelengths. In addition, Hamuy *et al.* (2000); Hamuy et al. (2001) find that lightcurve width is not dependent on host-galaxy metallicity. More importantly for cosmology, R99 used their sample of 22 local SNe Ia to demonstrate that any brightness variations between SNe Ia in different host-galaxy environments disappear after correction for lightcurve width. In particular, based a local sample of 14 SNe in E/S0 hosts and 27 in spiral hosts (including some from the R99 data), we find that after lightcurve-width correction there can be less than a 0.01 ± 0.05 mag offset between SNe Ia in local spirals and ellipticals. This indicates that lightcurve width is able to correct for age or other differences. Finally, Wang *et al.* (2003) demonstrate a new method, *CMAGIC*, which is able to standardize the vast majority of local SNe Ia to within 0.08 mag (in contrast to ~ 0.11 mag which lightcurve width corrections can attain (Phillips *et al.* 1999)). This imposes even more severe limits on the fraction of SNe Ia generated by any alternate progenitor scenario, or requires that variations in the progenitor properties have little effect on whether the resulting SN can be standardized. Therefore, if the local sample represents SNe Ia of all ages and metallicity, then these studies based on nearby SNe Ia of strongly limit the effects of supernova evolution.

The data from the new SNe Ia presented here do offer one new test for consistancy between low- and high-redshift SNe Ia. The quality of our HST data provides measurements of the SN peak magnitudes and lightcurve widths rivaling those for nearby SNe Ia. This allows a direct comparison between the stretch/luminosity relations at low- and high-redshifts. This comparison is shown in Figure 9. This plot shows graphically that the HST high-redshift supernovae are found at similar stretches as the low-redshift SNe, and are consistent with the same stretch/luminosity relationship.

5.9. Total Identified Systematic Uncertainty

The identified systematic errors are summarized in Table 9. Adding together these errors in quadrature, we obtain a total systematic error of 0.04 on the flat-universe value of $\Omega_{\rm M}$ (along approximately the minor axis of the confidence ellipses shown in $\Omega_{\rm M}$ vs. Ω_Λ plots); this smaller than our statistical uncertainty of 0.05. The total systematic uncertainty on $\Omega_{\rm M} + \Omega_\Lambda$ is 0.96 (along approximately the major axis of the confidence ellipses). Finally, for the low-extinction subset, we have a systematic uncertainty on w of 0.05.

When host-galaxy extinction corrections are applied, we have to consider the additional systematic effect of an uncertainty in the intrinsic value of U-B on determined color excesses. In this case, we have a total systematic error of 0.08 on the flat-universe value of $\Omega_{\rm M}$ or Ω_Λ, and a total systematic error of 2.6 on $\Omega_{\rm M} + \Omega_\Lambda$; as discussed in § 5.4, this

[Add a header that stretches accross all three of these columns and says: "Systematic Uncertainty on:"]

Uncertainty

Table 9: Identified Systematic Errors

Source of Uncertainty

Systematic	Flat-Universe Ω_M(or Ω_Λ)[a]	$\Omega_M + \Omega_\Lambda$	w[b]	Notes
Fit method	0.02 (0.4σ)	0.80	0.02	
Type contamination	0.01 (0.2σ)	0.28	0.04	
Gravitational Lensing	0.01 (0.2σ)	—	—	
Host-Galaxy Extinction	0.03 (0.6σ)	0.44	0.02	*c*
Intrinsic U-B: K-corrections	0.01 (0.2σ)	0.13	0.01	*c*
Systematic with host-galaxy extinction corrections:				
Intrinsic U-B: color excess	0.06 (0.6σ)	2.50	0.05	*d*
Dust Evolution	0.04 (0.4σ)	—	—	*d*

[[Delete these parentheses.]]

[[What does "absolute" mean here?]]

a: Each systematic is given as an absolute limit on the offset to the flat-universe value of Ω_M, and in terms of the smaller side of the statistical error bar (0.05 for Fit 3 to the low-extinction subset, 0.10 for Fit 6 to the full primary subset).

b: This is the offset on the maximum-likelihood value of w when the the low-extinction subset fits (Fit 3) is combined with the 2dFGRS and WMAP limits on Ω_M and w.

c: Only used where host-galaxy extinction corrections are not applied; when $E(B\text{-}V)$ corrections are applied, host-galaxy extinction is a statistical error.

d: Only used where host-galaxy extinction corrections are applied.

uncertainty enters in as

for the extinction corrected full primary sample

is likely to be an overestimate of the true systematic error. The total systematic uncertainty on constant w in this case is 0.07.

This is a little repetitious if left here, but it makes an important point, and it should be shortened and moved into item 5 of the conclusions.

The predominant effect of systematic errors is to move the confidence ellipses on the Ω_M versus Ω_Λ plane along their major axis; in some cases, these effects can be large. Therefore, any conclusions drawn from the positions of supernova confidence ellipses along this direction should be approached with caution. For example, many of these systematic errors could begin to move the confidence ellipses up and away from the flat-universe line of $\Omega_M + \Omega_\Lambda = 1$. Given these systematics, it would be premature to interpret this as a suggestion that supernovae may be inconsistent with a flat universe cosmology.

6. Summary and Conclusions

1. We present a new, independent set of 11 high-redshift supernovae ($z = 0.36$–0.86). These supernovae have very high-quality photometry measured with WFPC2 on the HST. The resulting higher quality lightcurve measurements have small enough errors on each $E(B\text{-}V)$ measurement to allow an unbiased correction host-galaxy reddening.

[Move this sentence to here.]

2. We have performed improved color and K-corrections, necessary to combine WFPC2 photometric filters with ground-based photometric filters. A reanalysis of the P99 supernova lightcurve data with these new corrections shows that the cosmological conclusions of P99 are robust, although there is a small adjustment in the best fit values of the parameters Ω_M and Ω_Λ.

3. The cosmological fits to Ω_M and Ω_Λ are consistent with the SCP's previous results (P99), providing strong evidence for a cosmological constant. This is a significant confirmation of the results of P99 and Riess (1998), and represents a complete independent new set of high-redshift supernovae yielding the same results as the earlier work.

Re-word item 4 to make clear what is primary fit of paper, and to simplify language

4. Under the assumption of a flat universe, we find a value of $\Omega_M = 0.21^{+0.06}_{-0.05}$ (statistical) +/- 0.05 [CHECK] (identified systematic) (where host-galaxy extinction is handled by omitting severely reddened supernovae) or $\Omega_M = 0.18^{+0.11}_{-0.10}$ (statistical) +/- 0.08 (identified systematic) (where extinction corrections are applied individually to each SN without any assumptions about the intrinsic $E(B\text{-}V)$ distribution). Our best confidence regions for joint fits on Ω_M versus and Ω_Λ, including all the high-redshift supernovae, are shown in Figure 10. 4 [this will be the new Figure number for Figure 10, after it is moved up.]

5. Most identified systematic errors affect the

[Reorder the points in this Conclusion as follows: 1 (with sentence from 2), then 3, then 5 (with material from last paragraph of Section 5.9), then 4, then 6.
An alternative order of this same material would be: 1,4,6,3,5.]

[There is no longer any section at all discussing consistancy of Omega_m measurement, etc., with other measurements. Maybe this would make a good (final?) point (#7?) in the Conclusions.]

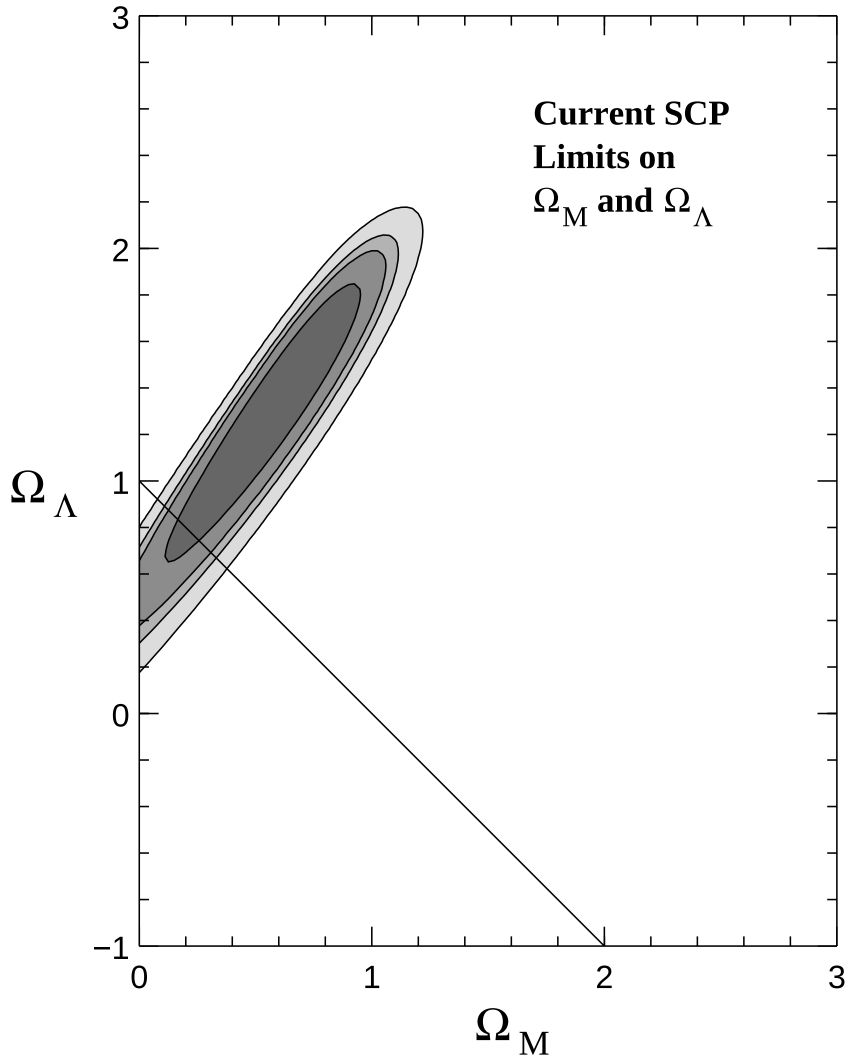

Fig. 10.— Primary confidence ~~intervals on~~ region for Ω_M and Ω_Λ resulting from this paper. ~~Both sets of contours include all low-z data used in this paper, plus all of the current SCP high-redshift supernovae data, including supernovae from P99 and the WFPC2 supernovae observed in this paper. The filled confidence regions are from Fit 3, which omit supernovae likely to be reddened ($E(B$-$V) > 3\sigma$ and $E(B$-$V) > 0.1$). The dashed lines are confidence regions where $E(B$-$V)$ host-galaxy extinction corrections have been directly applied.~~ The region shown is from Fit 3 for the low-extinction primary subset.

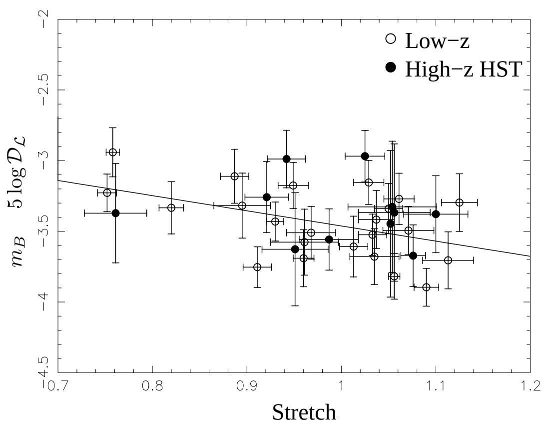

Fig. 9.— Stretch/Luminosity relationship for low-redshift SNe (open circles) and high-redshift HST SNe (filled circles). Each point is the measured m_B for that supernova, minus $\mathcal{D}_\mathcal{L}$, the "Hubble-constant-free luminosity distance" (see § 2.5), plotted against the stretch of that SN. The line drawn represents the best fit values of α and $\mathcal{M}$ from Fit 6, the fit to all Subset 1 supernovae with host galaxy extinction corrections applied.

cosmological results primarily by moving them along the direction where they are most uncertain, that is, along the major axis of the confidence ellipses. This corresponds to a greater error on $\Omega_M + \Omega_\Lambda$ than on Ω_M Ω_Λ (or, equivalently, on Ω_M or Ω_Λ alone under the flat-universe assumption that $\Omega_M + \Omega_\Lambda = 1$). Our total identified systematic error for the low-extinction ~~sample~~ analysis is 0.04 on the flat-universe value of Ω_M or Ω_Λ, and 0.96 on $\Omega_M + \Omega_\Lambda$. When host-galaxy extinction corrections *are* applied, a conservative estimate of the total identified systematic error is 0.08 on the flat-universe value of Ω_M or Ω_Λ and 2.6 on $\Omega_M + \Omega_\Lambda$.

[Doesn't agree with number in abstract.]

primary subsample

for the full primary subsample

6. When combined with 2dFGRS galaxy two-point correlation data, and WMAP CMB data, we find a value for the dark energy equation of state parameter w = $1.15^{+0.17}$ 0.22, under the assumptions that the Universe is spatially flat and that w is constant in time. The identified systematic uncertainty on w is 0.05 (or 0.07 with host-galaxy extinction corrections applied). The supernovae data are consistent with a low-mass Universe dominated by vacuum energy (w = 1).

The current confidence regions are shown in Figure __.

but they also are consistent with a wide range of constant or time-varying dark energy models.

The authors wish to thank our HST program coordinator, Doug Van Orsow for his help in the planning, scheduling, and execution of the observations presented herein. Support for this work was provided by NASA through ~~rants~~ HST-GO-07336.01-A and HST-GO-08346.01-A from the Space Telescope Science Institute, which is operated by the Association of Universities for Research in Astronomy, Inc., under NASA contract NAS 5-26555. The authors are indebted to Drs. Malcolm Smith and Patrick Hall for trading several crucial hours of observing time at the CTIO 4-m, which ~~helped to salvage~~ our SN search in March 1998. The authors acknowledge the tremendous help of the night assistants and support staff at the many telescopes from which data for this paper were obtained. We are particularly grateful to the CTIO support staff, who several times resurrected the disk drive containing time-critical data from one of our key search nights. Gary Bernstein and Tony Tyson ~~are thanked~~ for developing and supporting the Big Throughput Camera at the CTIO 4-m. This wide-field camera was important in the discovery of most of the high-redshift SNe presented in this paper, and enabled the high discovery rate needed to guarantee supernovae for follow-up with HST. The authors wish to recognize and acknowledge the very significant cultural role and reverence that the summit of Mauna Kea has always had within the indigenous Hawaiian community. We are most fortunate to have the opportunity to conduct observations from this mountain. This work was supported in part by the Physics Division, E. O. Lawrence Berkeley National Laboratory of the U.S. Department of Energy under Contract No. DE-AC03-76SF000098, by the Center for Particle Astrophysics, an NSF Science and Technology Center operated by the University of California, Berkeley, under Cooperative Agreement No. AST-91-20005.

grants

played a key role in

We thank

[[What about the WIYN queue observers (like Di Harmor, etc.) -- were they still very important for these SNe? I don't remember when they stopped.]]

[[For the lightcurve figures that Don is making: I think we should also consider what a version of this figure would look like if magnitudes were used instead of fluxes.]]