A cosmological intercept tension in local distance ladders

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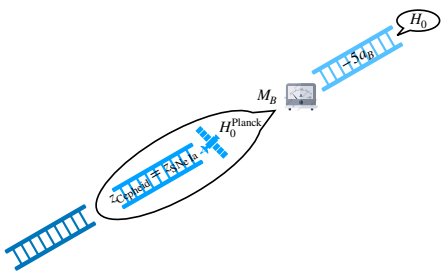
Cooperator: Shao-Jiang Wang

Method

Consistency between the second and third rungs

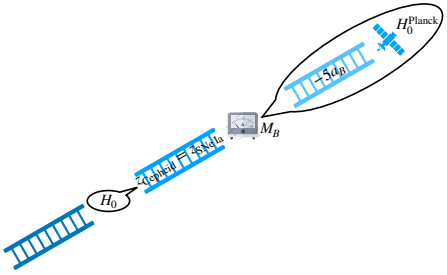
Two-rung measurements and the a_B intercept tension motivate comparing SNe Ia in Cepheid hosts $\mathcal{C}$ with Hubble-flow SNe $\mathcal{F}$.

(c) Forward consistency check



Forward: $\mathcal{C}$ calibrates $\mathcal{F}$.

(d) Backward consistency check



Backward: $\mathcal{F}$ calibrates $\mathcal{C}$.

Method

Two stages

Stage 1: infer the calibration

Fit one sample with Planck priors on H_0, Ω_m.

Stage 2: recover H_0

Fit the other sample using (M_B) posterior as its prior.

Check	Stage 1	Stage 2	Cosmological priors in stage 2
Forward	$\mathcal{C}$	$\mathcal{F}$	M_B
Backward	$\mathcal{F}$	$\mathcal{C}$	M_B and Planck Ω_m

The input reference is $H_0^{\rm Planck} = 67.36 \pm 0.54\,\mathrm{km\,s^{-1}\,Mpc^{-1}}$.

Method

Redshift correction

- The calibrator hosts lie at very low redshift, so peculiar velocities can make a large relative contribution to their observed redshifts.
- We correct their host-galaxy redshifts using the **Manticore-Local** (McAlpine et al. 2025) peculiar-velocity estimates.
- We compare results **with and without the redshift correction** in both the forward and backward consistency checks.

Method

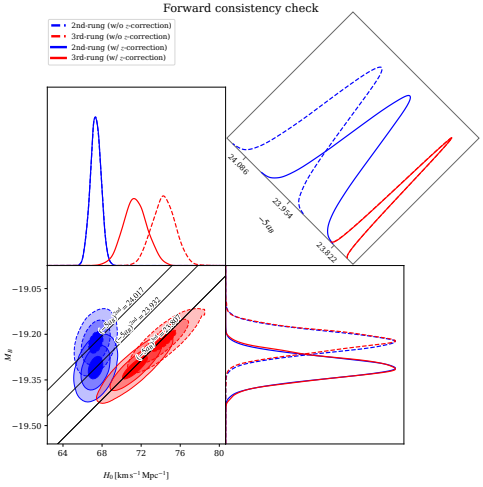
The cosmological intercept $-5a_B$

$$-5a_B = M_B + 5\log_{10}\left(\frac{c/H_0}{\mathrm{Mpc}}\right) + 25$$

- This parameter combines the influence of M_B and H_0 on calibration.
- We compare the results between the second rung and the third rung.

Result

Forward consistency check



Recovered H_0

w/o correction:
$74.30^{+1.18}_{-1.20}\,\mathrm{km\,s^{-1}\,Mpc^{-1}}$

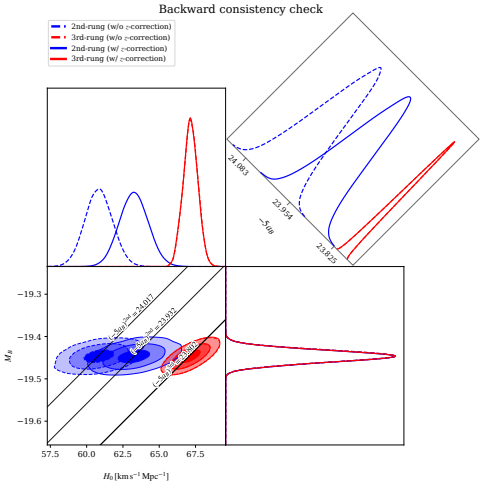
w/ correction:
$\mathbf{71.37}^{+1.23}_{-1.18}\,\mathrm{km\,s^{-1}\,Mpc^{-1}}$

Intercept $-5a_B$

Rung	w/o correction	w/ correction
2nd	24.017 ± 0.030	23.932 ± 0.030
3rd	23.807 ± 0.007	23.807 ± 0.007

Result

Backward consistency check



Recovered H_0

w/o correction:
$60.83^{+0.98}_{-0.97}\,\mathrm{km\,s^{-1}\,Mpc^{-1}}$

w/ correction:
$\mathbf{63.25}^{+0.95}_{-0.93}\,\mathrm{km\,s^{-1}\,Mpc^{-1}}$

Intercept $-5a_B$

Rung	w/o correction	w/ correction
2nd	24.017 ± 0.030	23.932 ± 0.030
3rd	23.802 ± 0.004	23.802 ± 0.004

Result

Significance of the intercept discrepancy between the rungs

Check	w/o correction	w/ correction
Forward	6.8σ	3.9σ
Backward	7.3σ	4.3σ

Conclusion

- Peculiar-velocity corrections reduce the discrepancy in both directions.
- A residual tension remains between the second and third rungs.

Thank you