Do We Live Within a Large Local Void?

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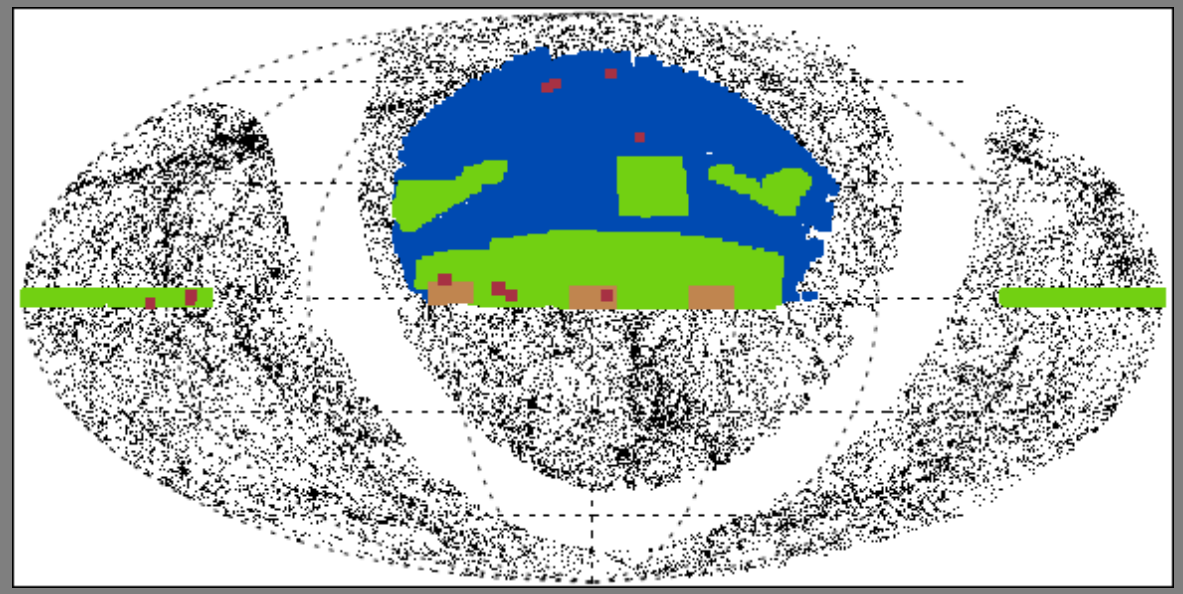
Astronomical Evidence: The KBC Void



- KBC generated wide-area, near-infrared (NIR) selected galaxy catalogs
- Measured mass density of local universe versus distance
- **Beyond ~1 billion light years, found rising mass density**

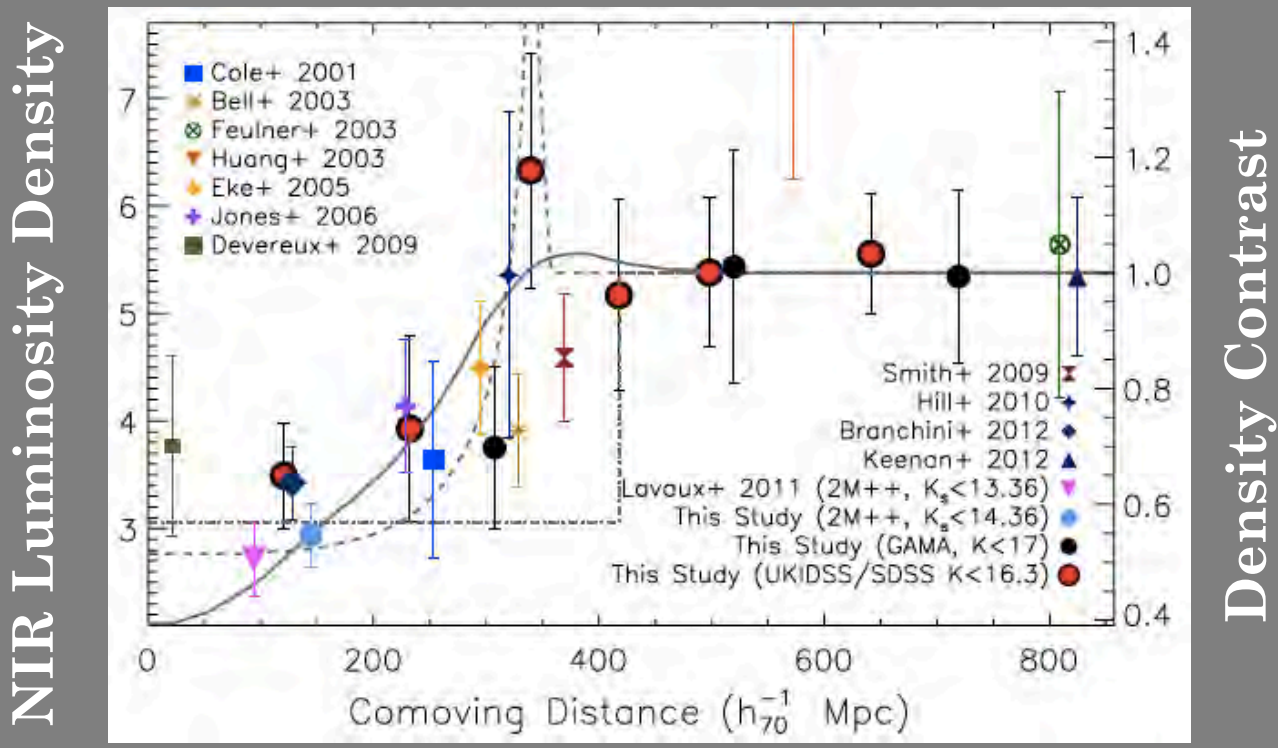


Image Credit: Keenan R. C., Barger A. J. and Cowie L. L. 2013 *ApJ* 775 62 (KBC)

- **~1.5 times higher density at >1.5 billion light years than locally!**

Tension in H_0

- Hubble constant (H_0) describes rate at which universe is expanding today
- H_0 estimated by different astrophysical methods:
  - Distance ladder ("Local")
    - $H_0 = 73.24 \pm 1.74$
  - CMB anisotropies ("Cosmic")
    - $H_0 = 66.93 \pm 0.62$
- Difference between the methods significant at **3.4σ** confidence level!
- **Could this difference be connected to our place in the "Local" universe?**

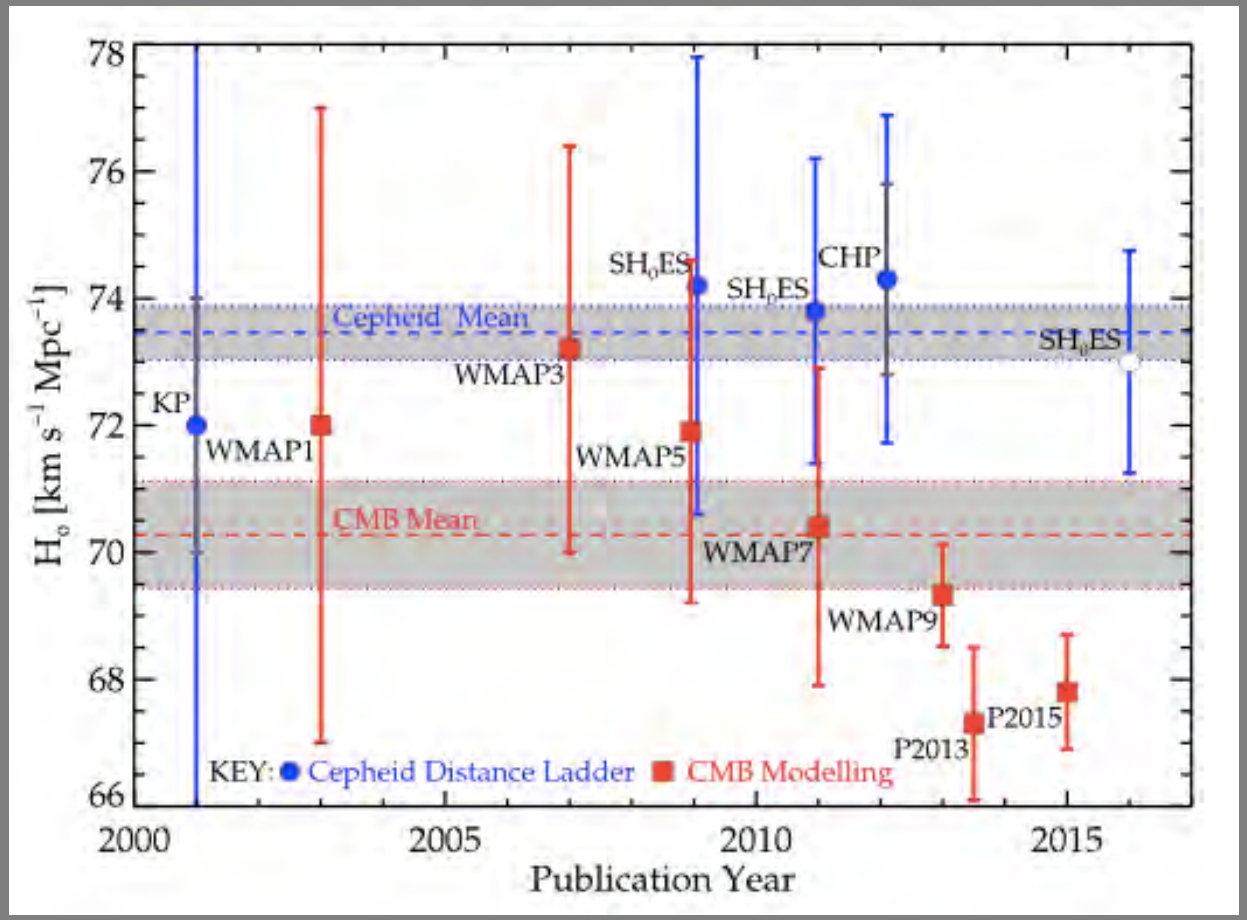
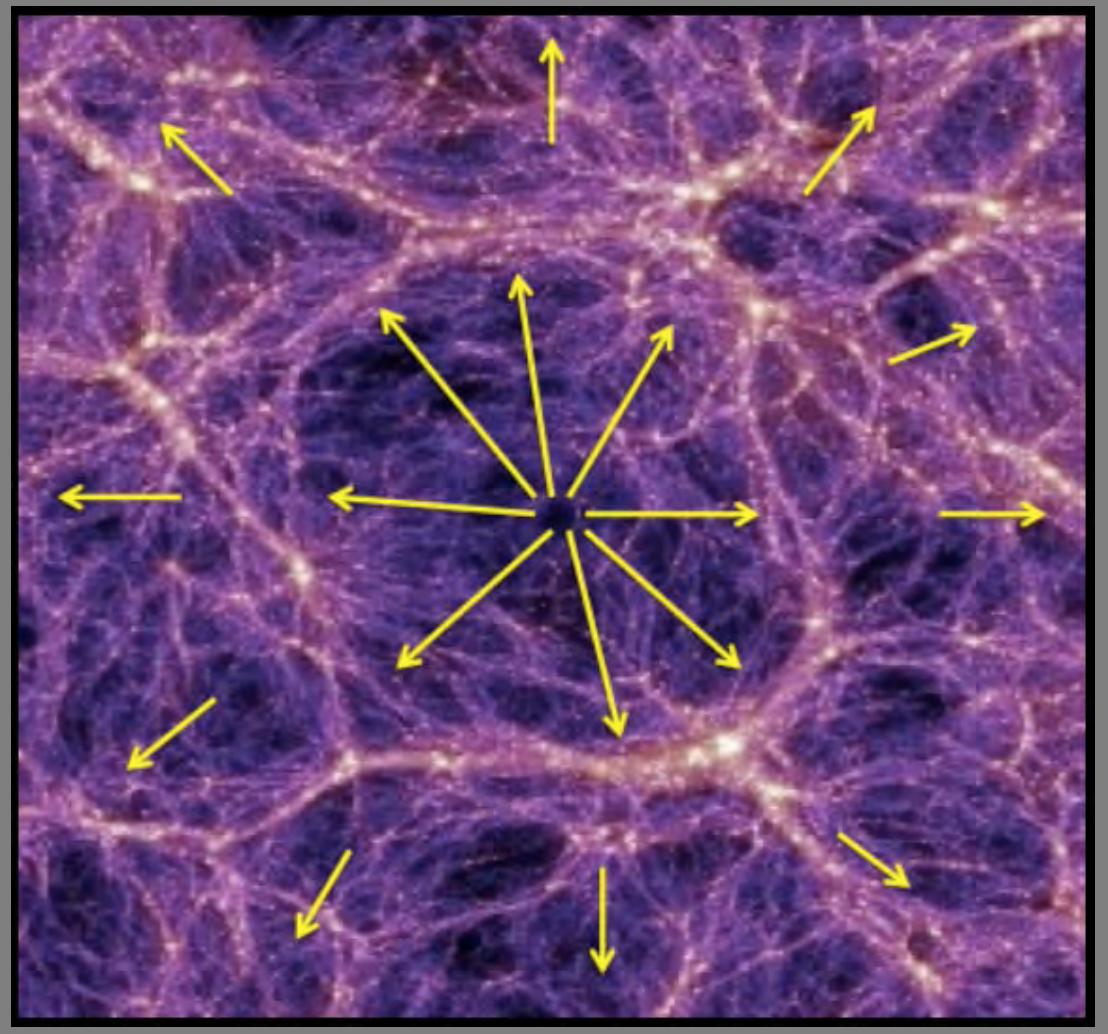


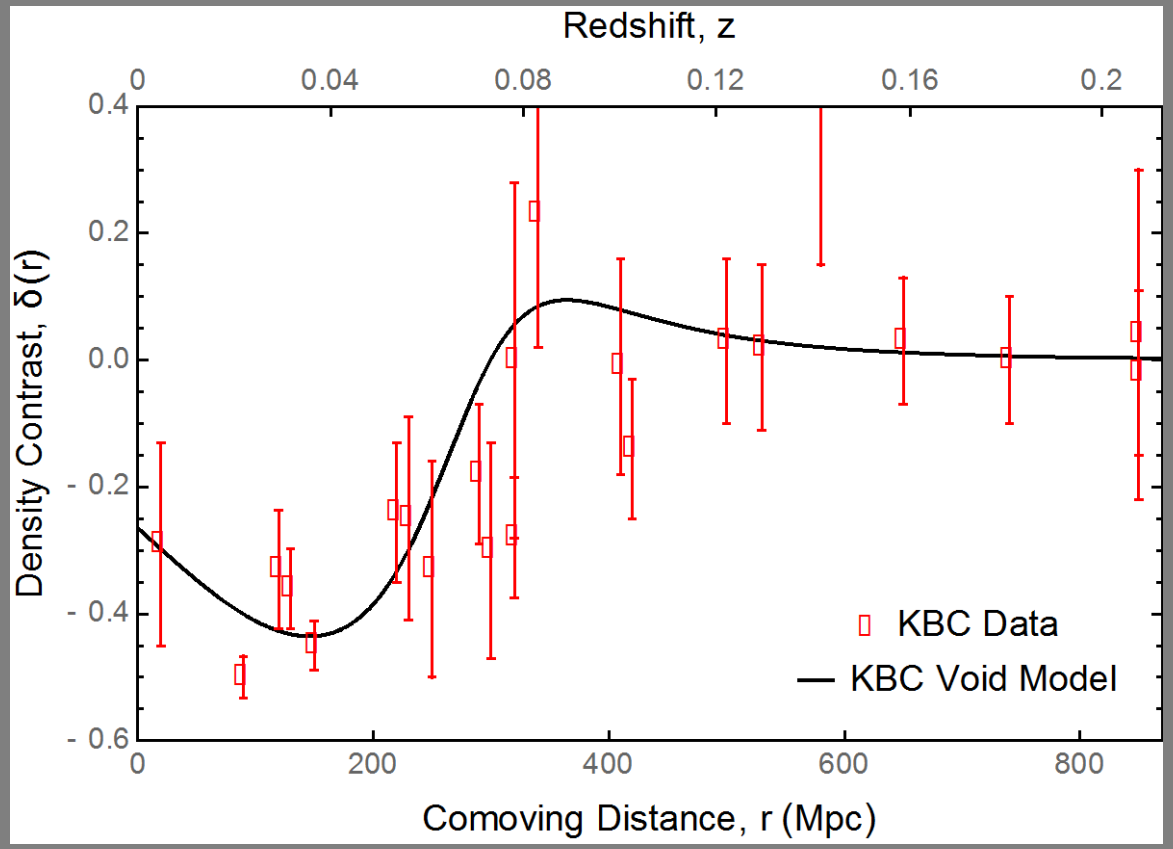
Image Credit: Beaton, Freedman *et al* 2016 *ApJ* 832 210

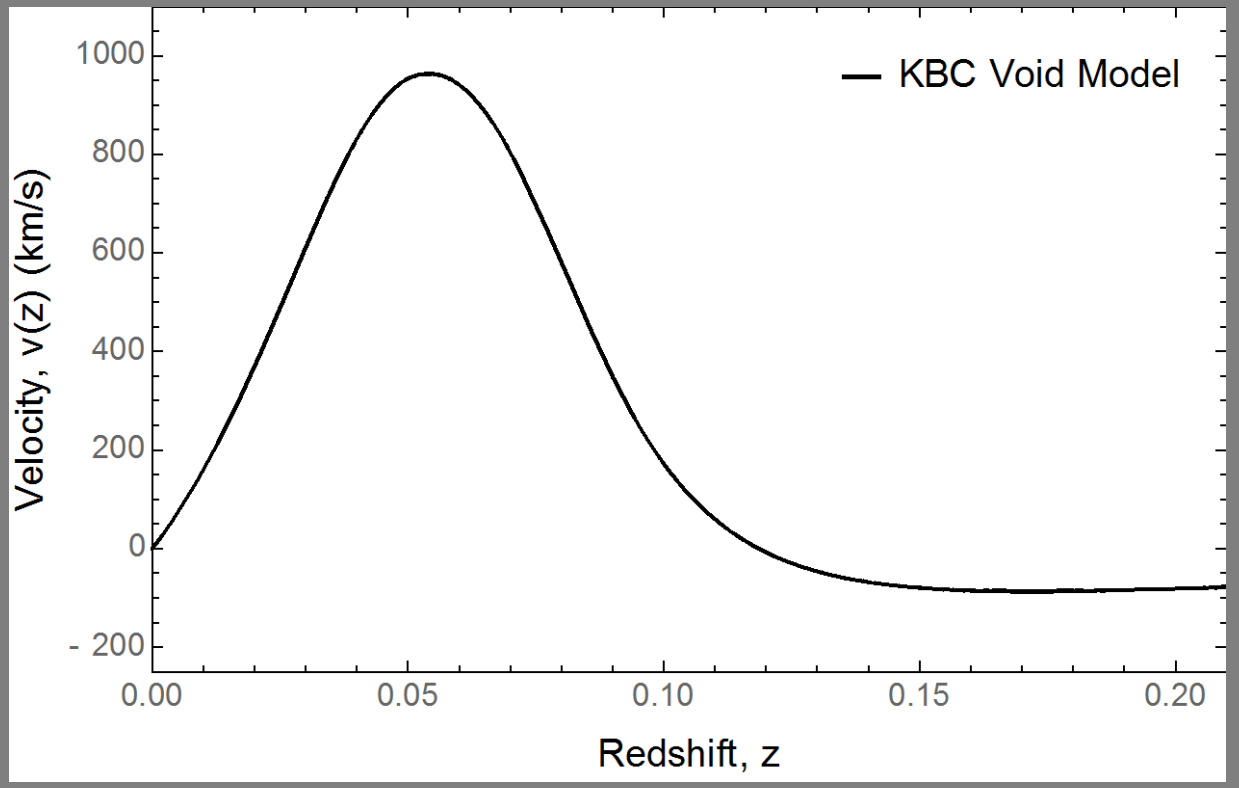
Modeling the KBC Large Local Void

- Objects within local void attracted outward by gravity, giving them a radial “pull”
- Different void mass density profiles lead to different radial “pulls”
- **What is the mass density profile of the KBC local void?**
- **How large is this “pull” ?**



Modeling the KBC Large Local Void



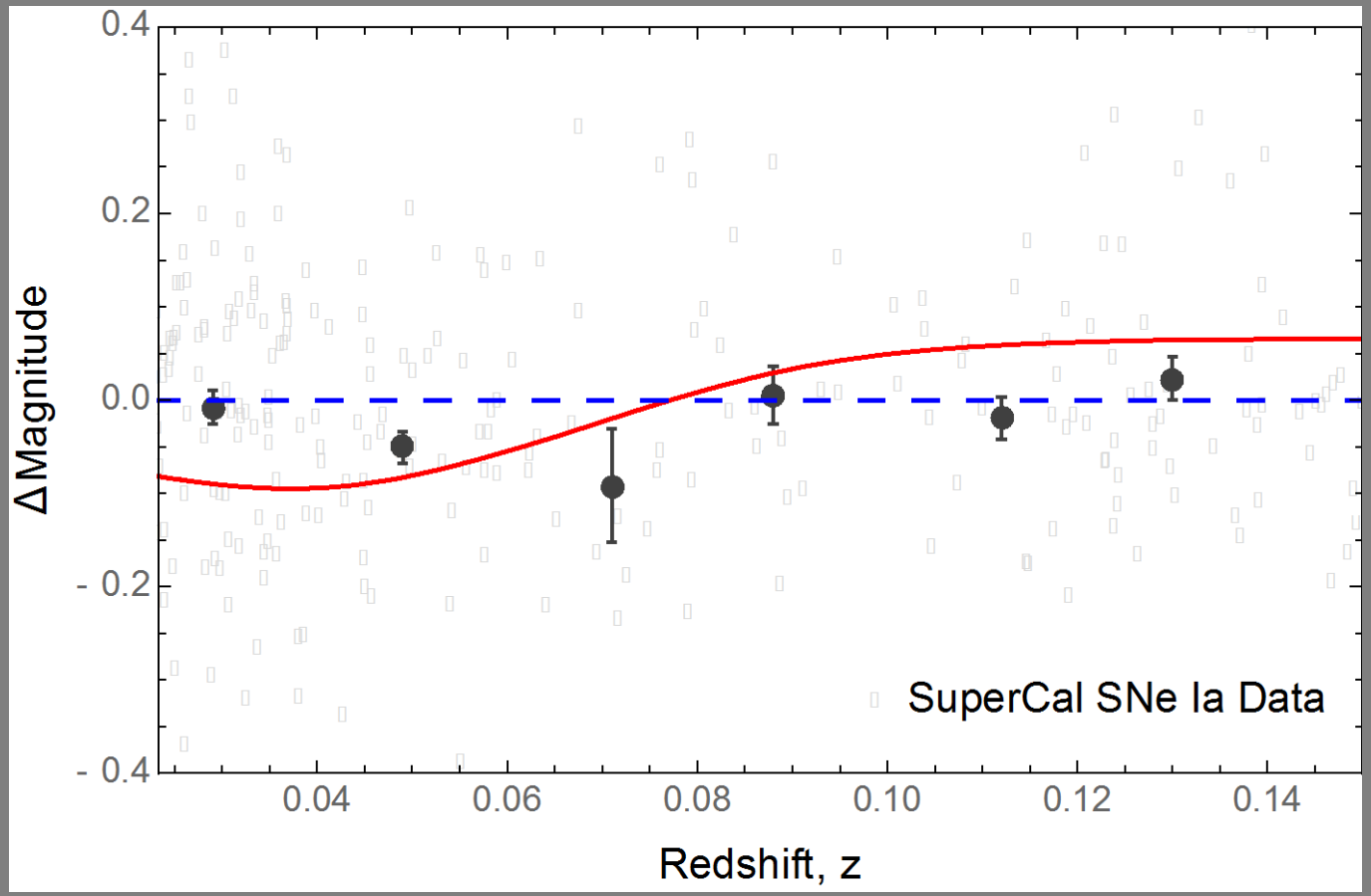


- ***Demonstration*** of local void effects
- **Parameterize** density contrast, δ, versus distance, r, assuming sphericity

- Local void adds non-negligible outward component to **velocity** of matter **within void**

KBC Void Consistent with Low-Redshift Supernovae Type Ia (SNe Ia)

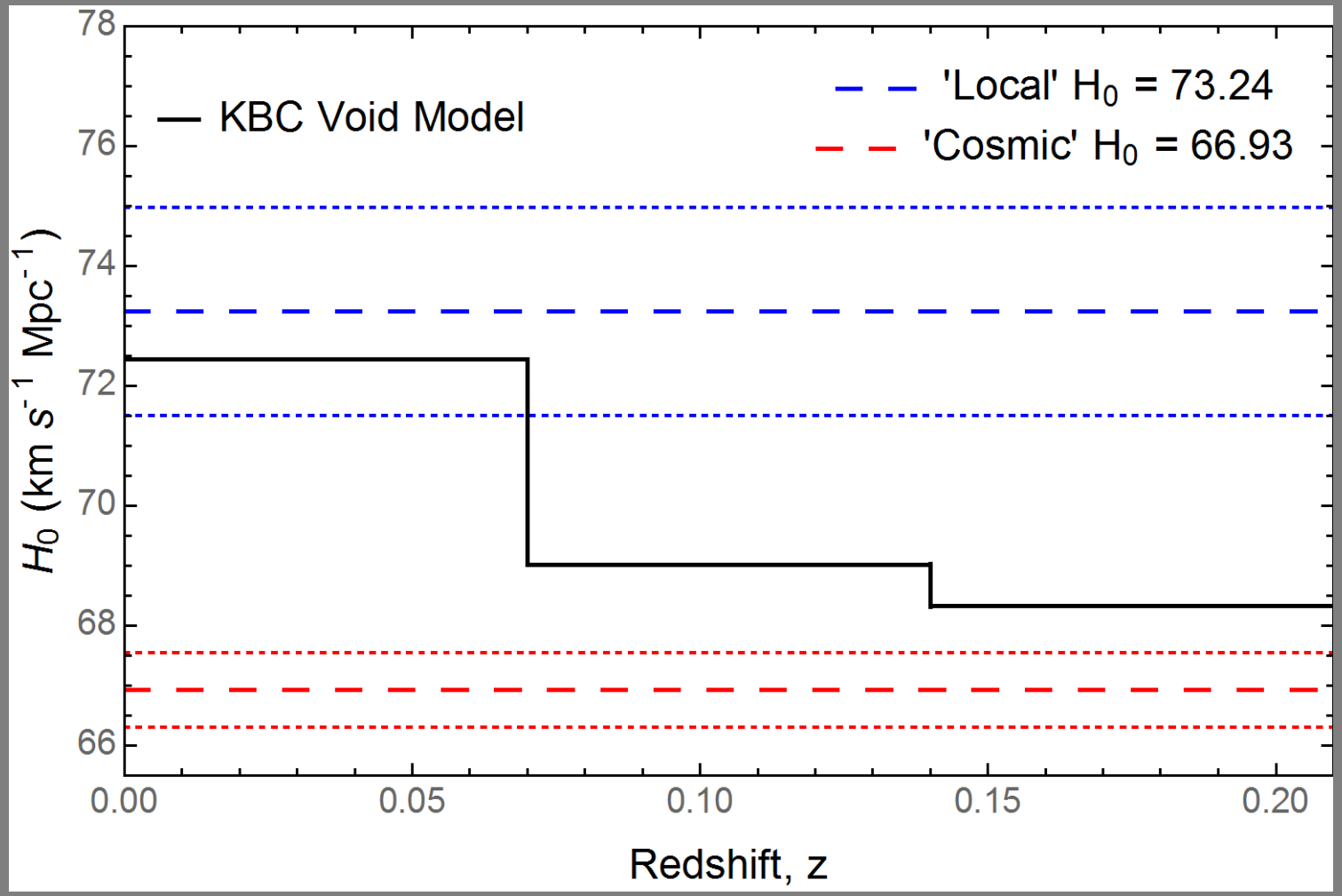
- **Large scatter in SNe Ia data**
- **Void distorts LCDM redshift dependence**
- What are the implications for measurements of H_0?



- SuperCal SNe Ia: Scolnic, Casertano, Riess *et al* 2015 *ApJ* 815 117

Void Ameliorates H_0 Tension

- **"Local" H_0 value does not capture void effects!**
- "Local" H_0 **higher** because void "pull" not accounted for
- "Cosmic" H_0 remains unchanged by void



Recap: Do We Live Within a Large Local Void?

- Astronomical Evidence: The KBC Void
- Currently, tension in "Local" versus "Cosmic" estimations of H_0
- Presence of KBC local void not included in SNe Ia "Local" H_0 determination
- **Model of KBC local void demonstrates how H_0 tension can be ameliorated by void effects**

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