Testing the Copernican Principle on large scales



Douglas Scott



We probably all think we live in a special place



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Vancouver, Canada



My lockdown project - walk everywhere in Vancouver!

Public observatory at Space Centre (has commemorative plaque)



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Polish-Canadian Care Home named after Copernicus (has commemorative plaque)









The Copernican Principle (in rhyming couplets)

The Copernican Principle is a scientific rule That says we're not at the center - it's a bit of a school

We used to think the Earth was the star of the show But now we know we're just one planet in a cosmic flow

Our sun is just one of many in the Milky Way And galaxies are scattered in an endless cosmic ballet

So though we might feel special on this tiny blue dot The Copernican Principle says we're really not a lot!

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Courtesy of ChatGBT

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Hard to test because observation are on the light cone Hence radial inhomogeneity, centred on us, will be consistent with isotropy In other words, it's hard to separate radial from temporal variations









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We live here



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- We'd have to live very close to the centre of an almost spherical void, unique with the observable Universe
- Best-fit models have very low local H_0 , as well as σ_8
- Poor fits to BAO
- Initial power spectrum would need to be tuned to fit
- Better fits come from "overcompensated" voids!
- Plus a CMB spectral distortion constraint







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How large could deviations from homogeneity be?

How can we probe unusual structures in the Universe more generally?





Zibin & Moss 2014, Zibin & Contreras 2017

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 But although we may not live in a special place, I am currently occupying a special time!