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Peculiar velocities and peculiar expansion: the timescape perspective

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The timescape model revisits the foundations of general relativity —the issues of quasilocal energy and angular momentum in a universe with large complex structures. Quantitative predictions had to wait til the 2020s for observations to reach a precision to distinguish the timescape model from the 100-year old Friedmann-Lemaître models, on which standard cosmology is based. With a huge variety of new data now pouring in, standard cosmology is increasingly challenged. But the timescape is fitting well [1], and offering new insights into simulations [2], new questions, and potentially a change to our fundamental paradigm.

Inhomogeneous exact solutions of Einstein's equations for cosmological relativity generally exhibit peculiar expansion distinguishable from peculiar motion on a FLRW background. The timescape is built on a quasilocal uniform Hubble expansion condition, which seeks a foundational basis for framing these distinctions. It leads to predictions now supported by very strong ($\ln B \sim 5$) Bayesian evidence [1]. The next phase will need collaboration with the observational peculiar velocity community. In this talk, I will present an overview aimed at fostering such joint exploration.

References

[1] A. Seifert, Z.G. Lane, M. Galoppo, R. Ridden-Harper and D.L. Wiltshire, *Supernovae evidence for foundational change to cosmological models.* MNRAS Letters, submitted (2024)

[2] M.J. Williams, H.J. Macpherson, D.L. Wiltshire and C. Stevens. *First investigation of void statistics in numerical relativity simulations.* arXiv:2403.15134 [astro-ph] (2024)

Author: WILTSHIRE, David

Presenter: WILTSHIRE, David

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