XXIII Simposio Chileno de Física
Chile,22-24 noviembre 2022 Gravitación y Cosmología

Hubble tension and matter inhomogeneities: A theoretical perspective

Marco San Martín[1]*, Carlos Rubio [2]†
[1]Escuela de Ingeniería Mecánica, Pontificia Universidad Católica de Valparaiso, Av. Los Carrera 01567, Quilpué, Valparaiso.
[2]Facultad de Ingeniería y Ciencias, Universidad Adolfo Ibañez, Diagonal Las Torres 2640, Peñalolén, Santiago.
*mlsanmartin@uc.cl, †carlos.rubio@edu.uai.cl

Introducción

We have studied how local density perturbations could reconcile the Hubble tension. We reproduced a local void through a perturbed FLRW metric with a potential Φ which depends on both time and space. This method allowed us to obtain a perturbed luminosity distance, which is compared with both local and cosmological data. We got a region of local parameters, q_0^{Lo} and j_0^{Lo}, which are in agreement with a local void of $\Omega_{m,void} = (-0{,}30 \pm 0{,}15)\Omega_m$ explaining the differences between the local H_0 and the Planck H_0. However, when constraining local cosmological parameters with previous results, we found that neither ΛCDM nor $\Lambda(\omega)$CDM could solve the Hubble tension.

Desarrollo

In a perturbed FLRW background by a potential $\Phi(r,t)$, the (perturbed) redshift of an emitted photon at time t_e and position r_e is given by[1]

$$z_e = \frac{a(t_0)}{a(t_e)} - 1$$

and

$$\delta z_e \;=\; \frac{a(t_0)}{a(t)}\left[-\Phi(r_e\hat{n},t_e) + \Phi(0,t_0) - 2\int_{t_e}^{t_0}\left\{\frac{\partial}{\partial t}\Phi(r\hat{n},t)\right\}_{r=s(t)} dt - \frac{a(t_e)}{c}\partial_r v^N(r_e\hat{n},t)\right]$$

where $a(t)$ is the usual scale factor and v^N is the velocity potential of the light source. The luminosity distance is then:

$$d_L(z,\delta z) \;=\; (1+z+\delta z)r + (1+z)\left[\frac{1}{2}(\Phi(r\hat{n},t) - \Phi(0,t_0))r - \int_0^r \Phi(r\hat{n},t_0)dr\right] + \mathcal{O}(\Phi^2)\,.$$

This expression will be helpful to compare with respect to Planck data.

Agradecimientos: C.R. is supported by FONDECYT grant 3220876.

Referencias

[1] M. San Martín and C. Rubio, doi = 10.48550/ARXIV.2107.14377,