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ΔΙΔΑΚΤΟΡΙΚΗΣ ΔΙΑΤΡΙΒΗΣ

ΘΕΜΑ: On the role and the implications of large-scale peculiar motions for the deceleration parameter of the universe

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Περίληψη

No real observer in the universe follows the smooth Hubble expansion, but we all move relative to it. Our Milky Way and the Local Group of galaxies, in particular, drift at a speed of around 600~km/sec. Also, a great number of recent surveys have repeatedly confirmed the presence of large-scale peculiar motions, the so-called ``bulk flows''. Despite this, peculiar motions are typically bypassed in most theoretical studies and, in the few studies they are included, the analysis is almost always Newtonian and takes the viewpoint of the idealised Hubble-flow observers, rather than that of their real bulk-flow counterparts. As a result, the full implications of our motion relative to the smooth universal expansion may not have been fully accounted for. However, relative-motion effects have long been known to interfere with the way the associated observers interpret their cosmos. In fact, the history of astronomy is rife with examples where relative motions have led to a gross misinterpretation of reality. This Thesis aims to provide a fully relativistic treatment of bulk peculiar flows and to investigate their implications for the way we understand the mean kinematics of the universe we live in and more specifically its acceleration/deceleration rate. The latter is monitored by the deceleration parameter, which traditionally is positive in a decelerated cosmos and takes negative values in an accelerating one. Introducing a ``tilted'' cosmological model, we allow for two families of observers. The first follows the smooth Hubble flow, which also defines the reference frame of the universe, while the second group of observers lives in typical galaxies, like our Milky Way, that drift relative to it. Assuming a perturbed Friedmann universe filled with pressure-free dust, we show that the deceleration parameters measured by these two observer

groups differ and that their difference is entirely due to relative-motion effects. In addition, using linear cosmological perturbations theory, we find that observers residing inside slightly contracting bulk flows may assign negative values to their locally measured deceleration parameter in a universe that is globally decelerating. Although this is an apparent local effect that is triggered solely by the observers' peculiar motion, the affected scales are typically large enough (between few to several hundred Mpc) to create the false impression that the whole universe has recently entered a phase of accelerated expansion. Indications that the scenario outlined above may be true and that the inferred recent universal acceleration may be a mere illusion and an artefact of our peculiar motion relative should be sought in the data. These should contain, among others, the trademark signature of relative motion, namely an apparent (Doppler-like) dipolar anisotropy triggered by the observers' peculiar flow. In other words, according to the data, the universe should appear to accelerate faster in one direction and equally slower in the opposite. Intriguingly, over тhe last ten years or so, there have been reports in the literature that such a dipole axis, may actually reside in the supernovae data. Put another way, our universe may indeed appear to accelerate faster towards one direction in the sky and equally slower along the antipodal.

Η παρουσίαση θα γίνει διαδικτυακά στον σύνδεσμο

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