[초CD-01] Recent progress in dark energy research

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Astronomical observations strongly suggest that the expansion rate of our universe is currently under acceleration. The nature of the so-called dark energy causing the acceleration is unknown, and it is one of the fundamental mysteries in the present day theoretical cosmology. Here we briefly review the current state of cosmic dark energy research in both theoretical and observational sides. Constraints on dynamical dark energy models (e.g., w-fluid, quintessence, and modified gravity) with recent observational data from type Ia supernovae, cosmic microwave background radiation, and large-scale structures in the universe indicate a preferred direction toward the simplest ΛCDM world model. We also discuss some issues regarding the early dark energy model and the spherical collapse of matter in the presence of dark energy.

[구CD-02] 21 cm signal from highly clustered Population III and Population II objects at high redshift

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We present a prediction for 21cm differential brightness temperature (dTb) from a set of strongly clustered sources of Population III and II objects at high redshift, from a suite of numerical simulations of their formation and radiative processes. These objects are located inside a highly biased density environment ("Rarepeak"), which is a rare, high-density peak which extends to ~7 comoving Mpcs. We study the impact on the resulting 21 cm signal from their ultraviolet and X-ray properties. The boost of emission (dTb>0) by high-density environment, moderate leakage of X-ray photons, and strong absorption due to Lyman-alpha pumping contrive to make Rarepeak a discernible, spatially-extended (sky angle~10') object around z~15, which is found to be detectable as a single object by Square Kilometre Array (SKA) with integration time of ~[600-2000] hours. We also examine detectability of many such peaks through SKA precursors.