

Chinese scientists reveal evidence of dynamical dark energy

An international research team led by Chinese astronomers revealed an evidence of dynamical dark energy.

The discovery, recently published on Nature Astronomy, with a News & Views article written by a world expert on cosmology, found that the nature of dark energy may not be the cosmological constant introduced by Albert Einstein 100 years ago, which is crucial for the study of dark energy.

The new study was supported by the National Natural Science Foundation of China (NSFC), Chinese Academy of Sciences, and a Royal Society Newton Advanced Fellowship.

Revealing the nature of dark energy is one of key goals of modern sciences. The physical property of dark energy is represented by its Equation of State (EoS), which is the ratio of pressure and energy density of dark energy.

In the traditional Lambda-Cold Dark Matter (LCDM) model, dark energy is essentially the cosmological constant, i.e., the vacuum energy, with a constant EoS of -1. In this model, dark energy has no dynamical features.

In 2016, a team within the SDSS-III (BOSS) collaboration led by Prof. Gong-Bo Zhao of National Astronomical Observatories of China (NAOC) performed a successful measurement of the Baryonic Acoustic Oscillations (BAO) at multiple cosmic epochs with a high precision.

Based on this measurement and a method developed by Zhao for dark energy studies, the Zhao team found an evidence of dynamical dark energy at a significance level of 3.5 sigma. This suggests that the nature of dark energy may not be the vacuum energy, but some kind of dynamical field, especially for the quintom model whose EoS varies with time and crosses the -1 boundary during evolution, according to NAOC.

“As the Zhao team reported in this work, a dynamical dark energy model is able to naturally reconcile tensions between local and primordial measurements of cosmological parameters in the LCDM model,” Prof. Xinmin Zhang at the Institute of High Energy Physics (IHEP) of the Chinese Academy of Sciences (CAS) told Xinhua.

“Which makes a crucial step towards understanding the nature of dark energy,” he added.

The dynamics of dark energy needs to be confirmed by next-generation astronomical surveys. The team points to the upcoming Dark Energy Spectroscopic Instrument (DESI) survey, which aims to begin creating a 3D cosmic map in 2018.

In the next five to ten years, the world largest galaxy surveys will provide

observables which may be key to unveil the mystery of dark energy, according to a news release of NAOC.