

ADVANCES IN CONTEMPORARY PHYSICS

HIGH-ENERGY, COSMOLOGY,
AND SOFT MATTER



Editor:

Dr. Syed Salman Ahmad Warsi

Advances In Contemporary Physics

High-Energy, Cosmology, and Soft Matter

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COSMIC ACCELERATION: HISTORY AND EVOLUTION

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Late time cosmic acceleration of the Universe is one of the biggest and most interesting discovery of our time. It is supported by a number of observational investigations such as Type Ia supernova, cosmic microwave background radiation, surveys of large scale structure, and Planck 2018 results. In the standard framework based upon Einstein gravity, cosmic acceleration can be explained by an exotic fluid with large negative pressure filling the Universe, dubbed '*dark energy*'. The simplest candidate for dark energy is the cosmological constant Λ . In this chapter, we shall focus on the basic ingredients of the standard model of Universe, Friedmann-Lemaitre-Robertson-Walker metric, cosmological parameters, evidences of late time cosmic acceleration, cosmological observations, and the theoretical models of dark energy in the form of exotic matter and the large scale modification of gravity.

1. INTRODUCTION:

Astronomy is the broad scientific study of celestial objects and phenomena outside Earth's atmosphere, including stars, planets, moons, comets, asteroids, and galaxies. It involves observing and cataloging these objects to understand their properties, motions, and distributions. Astronomy provides the observational foundation by collecting data on celestial objects. Astrophysics is a branch of astronomy that focuses on understanding the physical properties and underlying processes of celestial bodies and phenomena. It applies principles of physics and chemistry to explain how objects like stars, black holes, and galaxies form, evolve, and interact. Astrophysics interprets the data of celestial objects through physical theories, explaining the mechanisms governing celestial phenomena. Cosmology is the study of the origin, evolution, large-scale structure, and eventual fate of the universe as a whole. It seeks to understand the universe's fundamental nature, including concepts like the Big Bang, cosmic inflation, dark matter, and dark energy. Cosmology builds upon both, using astrophysical insights and observations to develop models of the universe's origin and evolution. Together, these fields complement each other to deepen our understanding of the universe from individual objects to its entire structure and history. The prevailing theory about the origin and evolution of our Universe is called Big Bang theory, also known as standard model of cosmology. The general theory of relativity forms the basis for the standard model of cosmology. In 1915, Albert Einstein discovered the general theory of relativity followed by observational discoveries in the 1920s,