Title:	Cosmological Perturbations in Modified Gravity
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Keywords:	Cosmological Perturbations Gravity
Issue Date:	May-2023
Publisher:	IISER Mohali
Abstract:	Till now we have a great understanding of Einstein's theory of general relativity. Einstein- Hilbert action which has metric and cosmological constant in its Lagrangian, field equations which relate curvature with stress energy tensor of components present, and time dependent solutions of general relativity enable us to talk about the history of the universe and have provided the modern framework for cosmology, thus leading to the discovery of the Big Bang and cosmic microwave background radiation. Perturbation theory in general relativ- ity, evolution of perturbations, CMB anisotropies, and novel predictions of general relativ- ity, etc. are being studied and known to a greater extent. However, some limitations of General relativity, such as problem with cosmological con- stant Λ that explains the late time accelerated expansion of the universe, existence of space- time singularities, lack of a self-consistent theory of quantum gravity, etc. turns one to look towards other possible gravitational theories — (i) tensor theory of gravity; one looks at f (R) theory which gives us the freedom to explain the accelerated expansion and structure formation of the universe. One works out the set of field equations (coming from modified action) and Friedmann equations, (ii) scalar-tensor theory of gravity where dynamical vari- ables are scalar field and metric. In particular, main focus of this thesis is on Brans-Dicke theory of gravity which incorporates the idea of Mach Principle – a hypothesis that inertial forces experienced by a body in non-uniform motion are determined by distribution and quantity of matter in the universe, and also deviates from the idea of cosmological constant Λ. In a scalar-tensor theory, the gravitational constant 'G' in Lagrangian is replaced by 'α', a scalar field coupled to mass and geometry. We will look upon the field equations derived from this action and perturb those equations in order to study the evolution of cosmological perturbations (perturbations in metric, perturbation in density, etc.). We will study the evo- lution of metric potential for different values of Brans-Dicke parameter ω and scale modes. The thesis also includes evolution of perturbation in General Relativity in late times. The growth or decay of these perturbations can be calculated by solving differential equations which are derived from space-space, time-time and space-time component of Einstein's equations and it can be studied how the metric potential decays in late times in General Relativity.
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