Vita

Candidate's name: Mustafa Afzal Saeed

Universities Attended:

University of Management Sciences (2015)
Bachelors of Science

University of New Brunswick (2019)
Masters of Science
Physics

Cosmological Perturbation Theory in a Matter-Time Gauge

UNIVERSITY OF NEW BRUNSWICK

THESIS DEFENCE AND EXAMINATION

in Partial Fulfillment

of the Requirement for the Degree of
Master of Science

by

Mustafa Saeed

in the Department of Physics

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Physics Building, Room P204

Examining Committee

Dr. Viqar Husain	Supervisor
Dr. Edward Wilson-Ewing	Internal Examiner
Dr. Cliff Shaw	External Examiner
Dr. William Ward	Chair of Oral Examination

Abstract

This work examines cosmological perturbations in a Hamiltonian framework with a matter-time gauge. Einstein's field equations are written in a matter-time gauge. The perturbed three-metric of cosmology, its conjugate momentum and the shift are substituted in these equations. The equations of motion of the perturbations to linear order are derived. These equations are expanded in terms of spatial Fourier modes and are then decomposed into scalar, vector and tensor components. After fixing gauges and solving constraints we find that the scalar mode is ultralocal and that the vector modes vanish. We also see that the traceless transverse tensor modes give the known propagation equation for gravitational waves in an expanding, spatially flat, homogeneous and isotropic background.