

ChandraPrakash

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Education

Indian Institute of Technology Guwahati

M.Sc IN PHYSICS
GPA: 8.51/10

Guwahati
June 2023 – 2025

Savitribai Phule Pune University

B.Sc IN PHYSICS
GPA: 9.38/10

Pune
June 2020 – 2023

Skills

Programing: C, C++, Python, Fortran and Mathematica

Other: \LaTeX , Linux (bash scripting)

Research Interest

Early universe cosmology, Cosmological Collider Physics, Imprint of Quantum gravity in the early universe, string theory, and AdS/CFT; quantum black holes and entanglement; field theory in curved spacetime; early universe phase transitions and instanton dynamics.

Research Experience

Black Hole Entropy using Brick Wall Method

preprint

- STUDIED STATISTICAL INTERPRETATION OF BLACK HOLE ENTROPY USING 'T HOOFT'S BRICK WALL METHOD
- GENERALIZED THE WHOLE PROCESS AND EXPRESSED THE FINAL FORM IN TERMS OF METRIC COEFFICIENT
- PREPRINT ON ARXIV:2010.10868

Dec 2020-2021

Entanglement Entropy via Heat Kernel and Replica Trick

preprint

- STUDIED THE ENTANGLEMENT ENTROPY THROUGH REPLICA TRICK AND HEAT KERNEL METHOD
- APPLIED IT IN THE PRESENCE OF LORENTZ VIOLATING FIELD.
- AVAILABLE AT [RESEARCHGATE](#).

Oct 2022

Rotating Black Holes in Lorentz-Violating Gravity

In progress

- APPLIED NEWMANN JANIS ALGORITHM IN THE MODELS OF LORENTZ-VIOLATING GRAVITY
- STUDIED THE BLACK HOLE SHADOW OF THE RESULTING METRIC

Oct 2022

Wave particle duality and Quantum Field Theory

BSc Thesis

UNDER THE KIND GUIDENCE OF PROF. LALITA RANE.

- EXPLORED THE EIGENVALUE OF MOMENTUM OPERATOR IN QUANTUM FIELD THEORY FOR INVESTIGATING A POSSIBLE LINK WITH DE BROGLIE HYPOTHESIS.
- CONCLUDED DE BROGLIE HYPOTHESIS WAS THE STATEMENT ON THE EIGENVALUE OF MOMENTUM EIGENSTATE.

Nov 2022

Cosmological Collider Signatures in the Early Universe

MSc Thesis

UNDER THE KIND GUIDENCE OF DR. DEBAPRASHAD MAITY.

- STUDIED THE COSMOLOGICAL COLLIDER PHYSICS FROM BOOTSTRAP PERSPECTIVE AS WELL AS IN-IN FORMALISM.
- STUDIED HOW PARTICLE PRODUCTION AND QUANTUM FIELD DYNAMICS DURING INFLATION IMPRINT ON COSMOLOGICAL CORRELATION FUNCTIONS, WITH A FOCUS ON NON-GAUSSIANITY AND OBSERVATIONAL SIGNATURES IN THE CMB.
- INTRODUCING REHEATING IN COLLIDER PHYSICS TO STUDY ITS IMPRINT ON THE CMB.

August 2024-2025

Conferences, Workshops, Schools

IUCSS Summer School

LEARNED ABOUT THE LORENTZ AND CPT VIOLATING STANDARD MODEL EXTENSION

May 2021

String 2021

ATTENDED THE ONLINE INTERNATIONAL ANNUAL CONFERENCE ON STRING THEORY ABOUT RECENT DEVELOPMENTS

June 2021

Loop the Loop workshop

ATTENDED ONLINE WORKSHOP ON FEYNMAN CALCULUS AND ITS APPLICATIONS IN GRAVITY.

November 2024

GIAN course on Standard Model Effective Field Theory

ATTENDED SHORT COURSE ON EFFECTIVE FIELD THEORY

December 2024

Theoretical Foundation

General Relativity

coursework + self study

STUDIED AS PART OF CURRICULUM UNDER PH706 AND FROM SEVERAL TEXTBOOKS ON THE SUBJECT SUCH AS,

- GRAVITATION AND COSMOLOGY BY WEINBERG,
- GRAVITATION BY MISNER THORNE AND WHEELER,
- SPACETIME AND GEOMETRY BY SEAN CARROLL,
- GENERAL RELATIVITY BY WALD AND
- THE MATHEMATICAL THEORY OF BLACK HOLES BY S. CHANDRASEKHAR

Topics: Special Relativity: Inertial frames, rotating frames (tetrads, Fermi-Walker transport). Schild's thought experiment, Equivalence Principle; clock synchronization in curved spacetime; Gravitational Action, energy-momentum tensor, Einstein field equations, non-locality of gravitational potential energy, Schwarzschild solution, geodesics in Schwarzschild metric; Killing Vectors; Schwarzschild black holes, Gravitational Waves; Thermal history of the early universe, FRW universe and Inflation; Lack of spinor representation of $GL(4)$ and use of tetrad to introduce Spinors in general relativity.

Quantum Field Theory

coursework+self study

STUDIED AS PART OF CURRICULUM UNDER PH543 AS WELL AS FROM SEVERAL TEXTBOOKS SUCH AS

- THE QUANTUM THEORY OF FIELDS BY WEINBERG,
- QUANTUM FIELD THEORY AND THE STANDARD MODEL BY M. SCHWARTZ
- INTRODUCTION TO QUANTUM FIELD THEORY BY ANTHONY WILLIAMS
- QUANTUM FIELD THEORY AN INTEGRATED APPROACH BY EDUARDO FRADKIN

Topics: Klein Gordon equation, Dirac equation, Free propagators Quantization of fields, Real and charged scalars, Massless and massive vector and spinor fields Perturbation Theory, Feynman Rules, Renormalizability, QED and Electroweak Interactions, Wigner's classification of particles, Constraints and Dirac Bracket, BRST quantization, Fadeev Popov ghosts, Self Energy correction in QED, Renormalization in ϕ^3 and ϕ^4 theory, Renormalization in QED, RGE Equations, Effective Action, Euler Heisenberg Lagrangian, Spontaneous Symmetry breaking and Higgs Mechanism, Basics of QCD, Coleman-Mandula's No-go Theorem, Supersymmetry, method of induced representation in Poincare group and conformal group.

Quantum Field Theory in curved spacetime

self study

I FIND THE EARLY UNIVERSE AND ASPECTS OF FIELD THEORY WHICH OVERLAPS WITH GRAVITY VERY FASCINATING AND MY MASTERS PROJECT ALLOWED ME TO EXPLORE IT IN EVEN MORE DEPTH. I FOLLOWED:

- QUANTUM FIELD THEORY IN CURVED SPACETIME: QUANTIZED FIELDS AND GRAVITY BY LEONARD PARKER & DAVID TOMS
- QUANTUM FIELDS IN CURVED SPACE BY N. D. BIRRELL & P. C. W. DAVIES

Topics: Quantum Fields in Minkowski space, Basics of quantum field theory in curved spacetime, vacuum expectation value and in-in formalism, Particle creation by Black Holes.

Ideas in String Theory

self study

THIS IS SUCH A FASCINATING SUBJECT THAT I HAD TO EXPLORE IT. I FOLLOWED:

- A FIRST COURSE IN STRING THEORY BY BARTON ZWIEBACH
- STRING THEORY: VOLUME 1 BY JOSEPH POLCHINSKI
- INTRODUCTION TO SUPERGRAVITY AND ITS APPLICATIONS BY HORATIU NASTASE

Topics: Classical and Quantum Dynamics of Point Particles, Classical and Quantum Dynamics of Strings, Quantization of Strings, Conformal Field Theory in 2D: Radial quantization, Virasoro algebra, vertex operators, Light cone gauge, Compactification, Superstring Theory.