

Tathagata Karmakar

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University of Rochester

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Education

Year	Degree	Institute	Score
2018– Ongoing	Ph.D.	University of Rochester	
2014–2018	BS	Indian Institute of Technology, Kanpur	9.9/10

Publications

- Karmakar, T. Sarkar, T. *Gen Relativ Gravit* (2018) **50**: 85.

Academic Achievements

- Robert L. and Mary L. Sproull Fellow, UR.
- Selected as 2017 **S.N. Bose** scholar (by Winstep forward, SERB DST Govt. of India and IUSSTF).
- Received **Academic Excellence Award** for outstanding performance in academic years 2015-16 and 2014-15 (dean's office, IIT Kanpur).
- **KVPY (Kishore Vaigyanik Protsahan Yojana**, fellowship funded by **Department of Science and Technology, Government of India**, offered to selected students pursuing natural sciences) fellow since August 2014.
- Ranked in **top 1%** in **JEE(Advanced)2014** among 1,50,000 students appeared.
- Ranked in **top 0.04%** in **JEE(Main)2014** among 1.8 million students appeared.

Internships

- **Summer research assistant** at **Center for Computational Astrophysics (CCA), Simons Foundation, New York City.** (May-July, 2017)

Research Projects

- **Illustris and IllustrisTNG data analysis: A look at scaling relations (May 2017 – Ongoing)**
With Dr. Shy Genel and Dr. Rachel Somerville, CCA.
 - Studied the radii ratio of galaxies and their host dark matter halos (from Illustris and IllustrisTNG simulations) as a function of stellar mass, halo mass and redshift.
 - Compared simulation data with observations from Galaxy And Mass Assembly Survey.
 - Analyzed size differences between low and high star forming galaxies.Currently looking at halo mass-stellar radius relations.
- **Calculation of tidal disruption limit of stars near a rotating naked singularity (May 2016 – Mar 2017)**
With Dr. Tapobrata Sarkar, IIT Kanpur.
Work done (May 2016 to March 2017):
 - Found the general expression of coordinate transformations from Boyer–Lindquist to Fermi normal coordinates in rotating Janis-Newman-Winicour (JNW) metric.
 - Constructed the necessary equations to be solved in rotating JNW metric.
 - Found the expression of tidal potential faced by a star orbiting in equatorial circular orbit.
 - Calculated Roche limits in rotating naked singularity background.

- **Temperature distribution inside a hollow metallic cylinder (Oct 2016 – Dec 2016)**
As a member of a group of three students, under supervision of Dr. Rajeev Gupta and Dr. Manoj K. Harbola, IIT Kanpur.
 - Heated one side of a hollow Aluminium cylinder of height 20cm and diameter 15cm to 100°C using a heater attached to its surface.
 - Kept other half at 55°C using a cooling unit.
 - Measured the temperature inside the hollow cylinder at steady state using an array of LM35 temperature sensors. Temperature distribution inside the cylinder matched with electrostatic potential distribution inside long metallic cylinder with two halves at different potentials.
- **Introduction to the use of computational tools in high energy physics (May 2015 – July 2015)**
Under supervision of Dr. Pankaj Jain, IIT Kanpur.
 - Studied quantum scattering, Feynman diagrams, Fermi's golden rule for transition rates.
 - Learned ROOT (data analysis framework developed by CERN), used MCFM (Monte Carlo for FeMtobarn processes) to calculate cross sections for various collision processes at particle colliders.
 - Fixed MCFM which generated buggy .C files.
 - Calculated cross section of collision of two protons (first creating W^+ boson which decays into ν_e and e^+).

Project report available in the following link

http://home.iitk.ac.in/~karmakar/HEP_Summer_2015_Report.pdf

Skills

- Programming languages: **C, Fortran, Python.**
- Tools and software: **Mathematica, ROOT.**

Course Projects

- **Reproduction of magnetic field of the Sun using python (March 2017 – April 2017)**
Under supervision of Dr. Mahendra Kr. Verma, IIT Kanpur.
Reproduced the structure of toroidal and polar components of magnetic field of the Sun using spherical harmonics.

Other Projects

- **Astronomy Club, IIT Kanpur (May 2015 – June 2015)**
As a member of a group of three students, under supervision of Dr. Pankaj Jain.
 - Installed a small radio telescope at IIT Kanpur for the first time (bandwidth: 10-12GHz).

Selected undergraduate coursework

Astrophysics

Advanced general relativity and black holes

Electrodynamics I and II

Fluid mechanics and rate processes

Thermal Physics

Numerical Analysis

Linear Algebra and ODE

Partial Differential Equations

#(Laboratory based)

Classical Mechanics

Quantum Mechanics

Statistical Physics

Graph theory

Optics#

Nuclear and particle physics