Resume

Shibaji Banerjee

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Current Position:	Asst. Professor(Sr. Lect.), St. Xavier's College, Kolkata
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Education

Ph.D: Obtained Ph.D on thesis entitled "Some Aspects of Strange Matter in Astrophysics", 2005

Graduate School: Completed Post.MSc. Course in Saha Institute of Nuclear Physics, 1995-1996

Master's: Physics with specialization in High Energy Physics, University of Calcutta, 1995

Bachelor's: B.Sc with Physics(Hons), University of Calcutta, 1993

Special Responsibilities

Professor in Charge, P.G Physics Inception, formulation and implementation of a new P.G course in Physics with special emphasis on Astro/particle Physics in collaboration with CAPSS, Bose Institute, Kolkata (2006-2011)

Asst. Director, Fr. Lafonte Observatory, SXC Setting up new night and daytime observatories at St. Xavier's College, Kolkata and continuing work.(20014-present)

Lab. in Charge, Physics Management of the U.G and P.G Physics Laboratories, St. Xavier's College(2017-2019)

Ph.D Supervision Supervising two students (1) Sm. Rupa Basu (WOSA) (2) Shri Ashadul Halder (CSIR) towards their Ph.D from July 10, 2017 - present.

Synopsis of Research Work

With my collegues in Bose Institute, I have been involved in the investigation of the origin and properties of compact astrophysical objects endowed with strangeness, with the objective of finding out their relevance in the formation and evolution of the universe.

Together with the other members of the group, I have developed an unconventional model to describe the propagation of small lumps of Strange Quark Matter (SQM) or strangelets, through the Terrestrial atmosphere which can explain the essential features of exotic cosmic ray events charecterized by very low charge to mass ratio.

We have found an analytical expression for the Chandrasekhar Limit of Strange Quark Stars. In contrast to existing numerical estimates, we have tried to provide a clue as to why there should be at all any limit (specially when the quarks are taken to be massless), and how the limit should depend on the fundamental constants (including the bag constant) in the context of the Density Dependant Quark Mass Model.

We have expressed our point of view on the nature of dark matter and dark energy components of the universe without resorting to any exotic physics lying beyond the Standard Model of particle interactions and relying on the existence of a (possibly incomplete) putative first order QCD phase transition which occured in the microsecond era of the early Universe.

Currently, we are looking into gravitational wave generation scenarios in presence of massive third objects and their geometric properties related to their propagation. Of late, we have also been looking at novel particle physics candidates of dark matter.

List of Publications

1. Strangelets in terrestrial atmosphere, with S.K.Ghosh, S.Raha & D.Syam, *Journal of Physics*, 1999, **G25** L15

2. The Chandrasekhar limit for quark stars, With S.K.Ghosh & S.Raha, *Journal of Physics*, 2000 **G26** L1

3. Can Cosmic Strangelets Reach the Earth ?, With S.K.Ghosh S.Raha & D.Syam, *Physical Review Letters*, 2000, **85** 1384

4. Strange quark matter in cosmic rays and exotic events, With S.K.Ghosh, A.Mazumdar, S.Raha & D.Syam, *Astrophysics & Space Science*, 2000, **274** 655

5. Relics of the cosmic quark-hadron phase transition and massive compact halo objects, With A.Bhattacharyya, S.K. Ghosh, S.Raha, Bikash Sinha and H.Toki, *Nuclear Physics*, 2003, **A715** 827

6. Massive compact halo objects from the relics of the cosmic quark-hadron transition, With A.Bhattacharyya, S.K. Ghosh, S.Raha, Bikash Sinha and H.Toki, *Monthly Notices of the Royal Astronomical Society*, 2003 **340** 284

7. Quantum chromodynamics, phase transition in the early universe and quark nuggets, With A.Bhattacharyya, S.K. Ghosh, S.Raha, Bikash Sinha and H.Toki, 2003, *Pramana - Journal of Physics* **60**, 909

8. Some aspects of strangeness in astrophysics and cosmology With A. Bhattacharyya, S. K. Ghosh, S.Raha, B.Sinha, H.Toki, 2003, *Nucl.Phys.A* **721**, 1028

9. Cosmological dark energy from the cosmic QCD phase transition and color entanglement With A. Bhattacharyya, S. K. Ghosh, E.M Ilgenfritz, S.Raha, B.Sinha, E.Takasugi, H.Toki, 2005, *Phys.Lett.B* **611** 25

10. Strangeness, cosmological cold dark matter and dark energy With A. Bhattacharyya, S. K. Ghosh, E.M Ilgenfritz, S.Raha, B.Sinha, E.Takasugi, H.Toki, 2005, *J.Phys.G* **31** S857

11. Colour entangled orphan quarks and dark energy from cosmic QCD phase transition With A. Bhattacharyya, S. K. Ghosh, E.M Ilgenfritz, S.Raha, B.Sinha, E.Takasugi, H.Toki, 2006, *Nucl.Phys.A* **774** 769

12. Speeding up of Binary Merger Due to "Apparent" Gravitational Wave Emissions With A. Halder, S. K. Ghosh, S. Raha and D. Majumdar, 2018, *arXiv:1810.04477*

13. Intensification of Gravitational Wave Field Near Compact Star With A. Halder and D. Majumdar, 2019, *arXiv:1902.06903*

14. Mass and Life Time of Heavy Dark Matter Decaying into IceCube PeV Neutrinos With M. Pandey, D. Majumdar and A. Halder, 2019, *Phys.Lett.B* **797** 134910

15. Addressing γ-ray emissions from dark matter annihilations in 45 milky way satellite galaxies and in extragalactic sources with particle dark matter models With A. Halder, M. Pandey and D. Majumdar, 2020, *Monthly Notices of the Royal Astronomical Society* **500** 5589

16. Lower bounds on dark matter annihilation cross-sections by studying the fluctuations of 21-cm line with dark matter candidate in inert doublet model (IDM) with the combined effects of dark matter scattering and annihilation With R. Basu, M. Pandey and D. Majumdar 2020, *arXiv:2010.11007*

17. Chandrasekhar limit for rotating quark stars With A. Halder, S. K. Ghosh and S. Raha, 2021, *Phys.Rev.C* **103** 035806

18. Bounds on Abundance of Primordial Black Hole and Dark Matter from EDGES 21cm Signal With A. Halder, 2021, *Phys.Rev.D* **103** 063044

Synopsis of Coursework undertaken

1. Two year undergraduate (Hons.) courses in Mathematical Physics and Thermodynamics

2. One year undergraduate (Hons.) courses in Waves and Acoustics, Electronics and Quantum Mechanics

3. One year undergraduate (Hons.) course in computation (Fortran-90)

4. One semester U.G courses (Hons.) in Mathematical Physics with computation

5. Designed and delivered One Semester (Hons.) course in non-linear-dynamics with Maxima

6. One semester Post Graduate Courses on Mathematical Methods, Nonlinear Dynamics, Relativistic Quantum Mechanics, Physical Cosmology, Astroparticle Physics, Computing tools, Numerical Analysis, Computational Astrophysics and Astrophysics Lab.

7. Introductory Courses for Ph.D Entrants on computational methods (2017 and 2019)

8. One year Foundation courses for first year U.G Students including personality development (2021)