Associate Professor
Department of Mathematics & Statistics
Indian Institute of Science Education & Research   *somnath.basu@iiserkol.ac.in*
Mohanpur 741246, West Bengal, India

Education

Ph.D. in Mathematics
State University of New York, Stony Brook, USA, 2011
Advisor : *Professor Dennis P. Sullivan*
Thesis : *Transversal String Topology & Invariants of Manifolds*

M.Math (Hons.)
Indian Statistical Institute, Bangalore, India, 2005

B.Math (Hons.)
Indian Statistical Institute, Bangalore, India, 2003

Appointments

Riley Visiting Assistant Professor at SUNY-Binghamton [September 2011 - June 2014]

Assistant Professor at RKM Vivekananda University [July 2014 - May 2016]

Assistant Professor at IISER Kolkata [June 2016 - September 2019]

Associate Professor at IISER Kolkata [September 2019 - present]

Research Interests

String topology (algebraic and geometric structures on loop spaces)

Rational homotopy theory and invariants of manifolds

Enumeration of curves and singularities

Publications & preprints

Of Sullivan models, Massey products and twisted Pontrjagin products
Journal of Homotopy Theory and Related Structures, Vol. **13**, No. **1** (2015)
DOI : 10.1007/s40062-013-0057-0 (published online in 2013)
https://arxiv.org/abs/1209.3226

Transverse String Topology and the Cord Algebra (joint with J. McGibbon, D. Sullivan, M. Sullivan)
Journal of Symplectic Geometry, Vol. **10**, No. **2** (2015)
https://arxiv.org/abs/1210.5722

Enumeration of Curves with Two Singular Points (joint with R. Mukherjee)
Bulletin des Sciences Mathematiqúes Vol. **139**, No. **6** (2015)
https://arxiv.org/abs/1409.6702

Introductory Lectures on Surgery Theory (joint with T. Farrell)
Introduction to Modern Mathematics, *Advanced Lectures in Mathematics*, Vol. **33** (2015)

Homotopy groups and periodic geodesics of closed 4-manifolds (joint with S. Basu)
International Journal of Mathematics, Vol. **26**, No. **7** (2015)
https://arxiv.org/abs/1303.3328

Realizing congruence subgroups inside the diffemorphism group of a product of spheres
(Joint with T. Farrell)
Topology & its Applications, Vol. **202**, pp. 205–216, (2016)
https://arxiv.org/abs/1512.07959

Enumeration of Curves with One Singular Point (joint with R. Mukherjee)
Journal of Geometry & Physics, Vol. **104**, pp. 175–203, (2016)
https://arxiv.org/abs/1308.2902

Set Topology (with an appendix by A. Bhattacharya)
A book chapter in **Topology & Condensed Matter Physics**, *Texts and Readings in Mathematical Physics*, Vol. **19**, Springer (2017)

Homotopy groups of highly connected manifolds (joint with S. Basu)
Advances in Mathematics, Vol. **337**, pp. 363–416, (2018)
https://arxiv.org/abs/1510.05195

Nambu Structures and Associated Bialgebroids (joint with S. Basu, A. Das, G. Mukherjee)
Indian Academy of Sciences. Proceedings. Mathematical Sciences, Vol. **129**, article **12** (2019)
https://arxiv.org/abs/1502.06533

Homotopy groups of highly connected manifolds via loop space homology (joint with S. Basu)
Osaka Journal of Mathematics, Vol. **56**, No. **2**, (April 2019)
https://arxiv.org/abs/1601.04413

On the cohomology ring and upper characteristic rank of Grassmannian of oriented 3-planes (joint with P. Chakraborty)
Journal of Homotopy Theory and Related Structures, Vol. **15**, pp. 27–60, (2020)
https://arxiv.org/abs/1712.00284

Counting curves on a general linear system with upto two singular points (joint with R. Mukherjee)
https://arxiv.org/abs/1501.01557 [submitted]

A connection between cut locus, Thom space and Morse-Bott functions (joint with S. Prasad)
https://arxiv.org/abs/2011.02972 [submitted]

Honours & Awards

Selected as a laureate of the thematic trimester *Symplectic topology, contact topology, and interactions* at Henri Poincaré Institute in Paris during April-July 2021.

Recipient of the SERB-MATRICS grant 2018-2021
    - This is a 3-year grant awarded for research activities and related travel (Rs. 2,00,000 per year).

Invited to Université de Nantes for a visit during May-June 2017 and August-September 2015.

Invited to the Simons Center for Geometry & Physics for a visit during May 2015.

Receipient of AMS-Simons Travel Grant, 2013-2015
    - This is a 2-year grant awared for travel expenses related to research ($2,000 per year).

Focused Research Group Participant (2008-2012) in the NSF FRG grant: *How the Algebraic Topology of Closed Manifolds Relates to Quantum Field Theory and String Theory*
    - Named graduate student participant in collaborative research grant.

Invited Talks & Lecture Series

Associativity, Binary Trees and Stasheff's Polyhedra
Inter IISER-NISER Math Meet, IISER Tirupati, India [July 2021]

Lectures in Rational Homotopy Theory
ICTS workshop on *Dualities in Topology & Algebra*, ICTS, Bangalore, India [February 2021]

A Story of Hypocycloids & Special Unitary Matrices
Inter IISER-NISER Math Meet, IISER Mohali, India [July 2020]

On and Around Loop Spaces
Virtual Math Fest, India [July 2020]

A Story of Hypocycloids & Special Unitary Matrices
Conference on *Topology of Manifolds & Representation Theory*, ISI, Kolkata, India [August 2019]

How Many Pentagons Does a Football Have?
Science Camp, JBNSTS, Kolkata, India [March 2019]

Lectures on *Knot Contact Homology & Chekanov's examples*
NCM Workshop on *Contact & Symplectic Geometry*, IISER Bhopal, India [December 2018]

How Many Pentagons Does a Football Have?
Analytica, St. Xavier's College, Kolkata, India [September 2018]

Of Fixed Points & Hex

JBNSTS Workshop for scholars 2018, IISER Kolkata, India [May 2018]

Lectures on *Topology & Fundamental Groups in Physics*
Science Academy Refresher Course in *Basic Physics & Topology*, Sikkim University, Gangtok, India
[January-February 2018]

On the Cohomology Ring of Grassmannian of oriented 3-planes
7th Eastern Asian Conference on Algebraic Topology, IISER Mohali, India [December 2017]

Counting Curves and the Euler Class
Geometry & Topology Seminar, Université de Nantes, France [June 2017]

Associativity, Binary Trees and Stasheff's Polyhedra
Inter-IISER Mathematics Meet, IISER Pune, India [May 2017]

How Many Pentagons Does a Football Have?
Mathematics Colloquium, NISER, Bhubhaneswar, India [March 2017]

How Many Pentagons Does a Football Have?
One Day Seminar in Mathematics, J. K. College, Purulia, India [February 2017]

Lectures on *String Topology & Conformal Field Theory*
ATMW on *Algebraic Structures on Manifolds*, ISI, Kolkata, India [December 2016]

Associativity, Binary Trees and Stasheff's Polyhedra
Mathematics Seminar, NISER, Bhubhaneswar, India [November 2016]

Geodesics, Free Loop Space and Gromov's Conjecture
Advanced Instructional School on Algebraic Topology, NEHU, Shillong, India [June 2016]

Lectures on *Basic Topology*
SERB School on Topology & Condensed Matter Physics, S. N. Bose National Centre for Basic
Sciences, India [November 2015]

Lectures on *Counting Geodesics on Smooth Manifolds*
Workshop on Geometry & Topology, HRI, Allahabad, India [November 2015]

On Groups Acting on Manifolds
Geometry & Topology Seminar, Université de Nantes, France [September 2015]

The Closed Geodesic Problem for Four Manifolds
Conference on *Loop Spaces in Geometry & Topology*, Henri Lebesgue Centre de Mathémathiques,
Université de Nantes, France [September 2014]

Enumerating Curves and the Euler Class
Topology Seminar, Johns Hopkins University, USA [March 2014]

The Closed Geodesic Problem for Four Manifolds
Geometry & Topology Seminar, Binghamton University, USA [February 2014]

Some Thoughts on Loop Spaces

Mathematics Colloquium, RKM Vivekananda University, India [January 2014]

Enumerating Curves and the Euler Class
Mathematics Seminar, NISER, India [January 2014]

The Closed Geodesic Problem for Four Manifolds
Topology Seminar, Ohio State University, USA [November 2014]

The Closed Geodesic Problem for Four Manifolds
Conference on *Classification of Manifolds*, NEHU, Shillong, India [June 2013]

Transverse Strings, Knots and Configuration Spaces
Symplectic Geometry Seminar, Hamburg University, Germany [May 2013]

Transverse Strings, Knots and Configuration Spaces
Symplectic Geometry and Gauge Theory Seminar, Columbia University, USA [May 2013]

Transverse Strings, Knots and Configuration Spaces
Deformation Theory Seminar, University of Pennsylvania, USA [March 2013]

Transversal String Topology and Applications
Topology Seminar, Stanford University, USA [May 2012]

Massey Products, Configuration Spaces and minimal Models
Geometry & Topology Seminar, RKM Vivekananda University, India [January 2012]

Transversal String Topology & Applications
Geometry & Topology Seminar, Caltech, USA [November 2011]

Transversal String Topology and Applications
Geometry & Topology Seminar, Binghamton, USA [October 2011]

What is Transversal String Topology?
Dennisfest, Stony Brook University, USA [May 2011]

Transversal String Topology and Diffeomorphism Invariants
FRG Workshop, University of California, Berkeley, USA [January 2011]

An Introduction to String Topology
Indian Statistical Institute, Kolkata, India [January 2010]

Service

Organizer (with Samik Basu) of the Advanced Instructional School on "*Homotopy Theory*"
Indian Statistical Institute, Kolkata [May 13-25, 2019]

Organizer (with Ritwik Mukherjee & Rukmini De) of the international conference "*J-holomorphic Curves and Gromov-Witten Invariants*"
ICTS, Bangalore [December 25, 2017 - January 4, 2018]

Organizer (with Ritwik Mukherjee) of the Summer School "*J-holomorphic Curves and Gromov-Witten Invariants*"
NISER, Bhubaneswar [July 10-22, 2017]

Organizer (with Goutam Mukherjee) of the ATM Workshop on Algebraic Topology - *Algebraic Structures on Manifolds*
Indian Statistical Institute, Kolkata [December 13-22, 2016]

Teaching Experience

Lecturer for the following courses (at Binghamton, IISER, Stony Brook and Vivekananda):

A Transition to Advanced Mathematics
Algebra I
Algebraic Topology
Algebraic & Differential Topology
Applied Complex Analysis
Calculus III with Applications
Elementary Statistics for Biologists
Geometry of Curves & Surfaces
Introduction to Calculus
Linear Algebra
Number Systems
Ordinary Differential Equations
Proficiency Algebra
Riemannian Geometry
Topics in Topology : Connections, Curvature and Characteristic Classes
Topics in Topology : Fibre Bundles
Topology I

Guided students in reading courses on:

Topics in Topology : $K(G,1)$ and classifying spaces
Topics in Geometry : Orientations & Poincaré duality via homology & differential forms

Lecturer for the Center for Talented Youth (CTY) Mathematics Program, Stony Brook University

Games on Graphs - October 2009

Lecturer for WISE (Women in Science and Engineering) Program, Stony Brook University

Curves and Surfaces - Spring 2010
Topology of Surfaces and the Euler Characteristic - Spring 2011