Vijay Ganesh

Curriculum Vitae

(+91) 81728 20701
vijay13101996@gmail.com

Final year Integrated Masters student in Mathematics with a Bachelors in Chemistry.

Education

Jan, 2018 – Present **Masters in Mathematics and Scientific Computing** .
Indian Institute of Technology, Kanpur, GPA: 10.0

July, 2014 – Nov, 2017 **Bachelors of Science, Chemistry** .
Indian Institute of Technology, Kanpur, GPA: 8.8

Major Scholastic Achievements

- **Academic excellence award** for the academic year 2016-2017, awarded by IIT Kanpur.
- **Summer Research Fellow**, under the SRFP(Summer Research Fellowship Programme), sponsored by the academies of Sciences – INSA, IASc and NASI
- **Top 5 percentile** in Joint Entrance Examination (JEE)- Advanced 2014.
- Qualified for the **Indian National Chemistry Olympiad(INChO)**.
- Recipient of the **Kishore Vaigyanik Protsahan Yojana(KVPY) Fellowship**, awarded by the DST, India.

Projects

June, 2017 – Present **Wave-packet reconstruction from complex-valued classical trajectories for 2D systems using FINCO** .
Supervisor: Prof. David Tannor, Dept. Of Chemical Physics, Weizmann Institute of Science, Rehovot, Israel.

Complex trajectory based semi-classical methods prove to be a promising alternative to exact quantum mechanical methods, especially for systems with more than 5-6 degrees of freedom, and help overcoming the limitations of real trajectories in explaining strong quantum effects. We analyzed the usability of one such method (BOMCA) for 2D potentials, under the Final value representation for the Coherent propagator(FINCO). We obtained qualitative agreement with the exact quantum mechanical wave-function for the double slit potential in the classical limit, but observed that the real-time trajectories were unable to account for non-classical effects. Using the 2D complex time submanifold of the full riemann sheet in 10D, we visualized the local phase space and enumerated the various non-classical processes, possible in 2 dimensions. We visualized caustics in the 4D 'ket-manifold' of initial conditions and the stokes divergences that emanate from them, resulting in inaccurate wave-function reconstruction. *(Manuscript in preparation)*

May, 2016 – July, 2016 **Diffusion in the presence of a permeable barrier** .
Supervisor: Prof. KL Sebastian, Dept. Of Inorganic and Physical Chemistry, Indian Institute of Science (IISc), Bengaluru, India.

Anomalous diffusion offers interesting clues about the dynamics and environment of various natural process. In a series of experiments, Granick had studied processes which were anomalous in nature, yet had a Mean Square Displacement(MSD) linear in time, like a typical Brownian motion. We proposed a model to conceptualize one such process, with an anomalous probability distribution curve. An analytical solution was obtained using such a model, under the path integral- based approach, and was found to match the distribution curve, experimentally obtained.
Project report:

Jan, 2017 – Apr, 2017 **Protein Folding Biophysics: Theory and Experiment**, Course Project.
Supervisor: Prof. Srihari Keshavamurthy, Dept. Of Chemistry, Indian Institute of Technology, Kanpur, India.

Recent experimental result of Chung and Eaton has shown that the diffusion coefficient and free energy barrier of the protein folding process, can be obtained from the temperature and viscosity dependence of 'transition path time'. In our systematic exposition of theory and experiments in the field of protein folding biophysics, we explained the structural and dynamical aspects of the protein folding problem: The role of spin glass model and random energy model in explaining the structural stability of proteins in the native state, and Kramer's reaction rate theory and transition path formalism, in explaining the mean first passage time and multi-exponential kinetics observed.

Term paper:

Aug, 2016 – Nov, 2016 **Dynamical tunnelling in model systems**.
Supervisor: Prof. Srihari Keshavamurthy, Dept. Of Chemistry, Indian Institute of Technology, Kanpur, India.

Systems with discrete symmetry in the underlying phase space have typically exhibit enhanced energy flow rates owing to dynamical tunnelling. A recent paper from Heller's group had analysed model vibrational coupling schemes and compared between energy flow rates by dynamical tunnelling and classical energy flow rates by fast diffusion, in the best case scenario, where the classical rates are the fastest possible. The tactically constructed non-convex Hamiltonian, ensured that fast diffusion is possible along the Arnold web, unbounded by Nekhoroshev's theorem. As a part of the reading project, the possible role of resonance assisted tunnelling in the effective perturbed harmonic oscillator hamiltonian was studied.

Experience

May, 2017 – July, 2017 & May, 2018 - July, 2018 **Visiting student at the Weizmann Institute of Science, Rehovot, Israel** .
Worked on a research project in Quantum dynamics, with Prof. David Tannor and Dr. Werner Koch

Aug, 2017 – Present **Part-time Research Consultant for WorldQuant, LLC.** .
Developing fundamental and technical investing strategies for portfolio optimization.

Relevant Courses

Quantum Mechanics(A*)	Chemical binding(B)	Topology(A)
Statistical Mechanics(A*)	Quantum Magnetism(A)	Algebraic Topology(A)
Molecular Spectroscopy(A*)	Real Analysis(A*)	Electrodynamics(B)
Non-linear Dynamics(A*)	Complex Analysis(A)	Algebra(B)
Reaction Rate Theories(A)	Several variable Calculus(A)	Time Series Analysis(*)

* - *Ongoing* *A** - *Awarded for Outstanding performance*

Technical Skills

Languages C, C++, Python, Mathematica
Tools Git, LaTeX

Extra-curricular activity

- **Volunteer for the Alumni Contact Program, (ACP):**
  - Helped maintain and update the Alumni database by regular telephonic calls and emails. Organized and managed various talks and events by illustrious Alumni.
- **Academic Mentor, under Counseling Service, IITK:**
  - Provided academic assistance, in the form of doubt clearing sessions and remedial classes, to students facing issues in understanding concepts in the compulsory core course – Introduction to Electrodynamics.