



Title	<b>Dr.</b>	First Name	<b>Ram Kuntal</b>	Last Name	<b>Hazra</b>	Photograph
Designation	<b>Associate Professor</b>					
Address	<b>Department of Chemistry (Physical) University of Delhi, Delhi, India</b>					
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<b>Educational Qualifications</b>						
Degree	Institution				Year	
<b>Ph.D.</b>	<b>Indian Association for the Cultivation of Science, Jadavpur University</b>				<b>2002-2009</b>	
<b>PG (M.Sc.)</b>	<b>Indian Institute of Technology, Roorkee, Uttaranchal</b>				<b>1999-2001</b>	
<b>UG (B.Sc.)</b>	<b>B. Sc. (Hons.), Chemistry, University of Burdwan</b>				<b>1998</b>	
<b>10+2</b>	<b>West Bengal Council of Higher Secondary Education</b>				<b>1994</b>	
<b>Madhyamik</b>	<b>West Bengal Board of Secondary Education</b>				<b>1992</b>	
<b>Extra-curricular Activities</b>	<b>Grade-II, Classical Guitar, Trinity College London, 94%, Distinction</b>				<b>2013</b>	
<b>Membership</b>						
<ul style="list-style-type: none"> <li>• <b>CRSI Lifetime membership No.: LM 3231</b></li> <li>• <b>Life Member, No. 8554, Indian Chemical Society</b></li> </ul>						
<b>Career Profile</b>						
<ul style="list-style-type: none"> <li>• <b>Postdoctoral Fellowship in ETH-Zurich, Professor Dr. Michele Parrinello Group (2008-2009).</b></li> <li>• <b>Dr. D. S. Kothari Postdoctoral Fellowship, (UGC, MHRD), Professor Kamal Bhattacharyya (2009-2010).</b></li> <li>• <b>Visiting Fellow, Weizmann Institute of Science, Professor Eli Pollak, June 2008.</b></li> <li>• <b>CSIR-UGC NET, December 2000, (Junior Research Fellow) (JRF).</b></li> <li>• <b>Selected for pursuing Ph.D. in Organic Chemistry, IIT Bombay (2001).</b></li> <li>• <b>Within Top 20% in CSIR-UGC NET, December 2000, Called for SPM Fellowship.</b></li> </ul>						

- **CSIR-UGC NET, June 2003 (LS).**
- **GATE (IITK) 2001, 97.68 percentile, Rank 44.**
- **Rank-1, Appointment for the Post of Assistant Professor, Department of Chemistry, University of Delhi, 2010.**
- **Madhyamik, West Bengal Board of Secondary Education, Rank-121.**

#### Administrative Assignments

- **Member, Department Research Committee 2015-2017**
- **Member, Seminar Committee 2015**
- **Teacher-in-charge, High Performance Computing facility 2017-present**

#### Areas of Interest / Specialization

- **Analytical theory for electron-rich and exciton complexes' interactions of quantum dots and mesoscopic systems in both zero- and non-zero electrical and magnetic confinements within nonrelativistic quantum mechanics**
- **Analytical theory for atoms and ions beyond He-isoelectronic series using Green's function expansion of Coulomb interactions within Born-Oppenheimer approximations**
- **Multi-configuration treatment to Period-II elements: Coulomb Green's function**
- **Analytical treatment H<sub>2</sub> utilizing Coulomb Green's function (in future)**

#### Subjects Taught

- **Quantum Chemistry, Paper-103, (2010-2014)**
- **Introductory Chemistry, NSNT-103, M Tech (NSNT) 2010**
- **Statistical mechanics & others, Paper-203, (2016, 2017)**
- **Advanced Quantum Chemistry, Paper-4305, (2018-2019)**
- **Quantum Chemistry, Paper-103A, 2019**
- **Quantum Chemistry, Paper-103B, 2020, 2021, 2022**
- **Statistical Mechanics, Paper-203A, 2020, 2021, 2022**
- **Lab Work of Chemistry, M Tech (NSNT), (2010-2013)**
- **Lab Work + Project Evaluation, Paper-4312, 2011**
- **Introductory Quantum Mechanics, NSNT-203, M Tech (NSNT) (2011-2014)**
- **Lab Work, Paper-104 & 204, Department of Chemistry, (2012-2017)**
- **Mentored Projects of M. Tech. (NSNT) in 2012**

## Research Guidance

- **Number of Mentoring PhD students: 1**
  1. **Ms. Bharti Kapil**
  
- **Number of PhD students mentored: 4**
  1. **Dr. Sunny Singh, Teaching & Social Activist**
  2. **Dr. Priyanka Aggarwal, Postdoctoral Fellow, Asia Pacific Center for Theoretical Physics, Pohang, POSTECH, Korea**
  3. **Dr. Harsimran Kaur, Postdoctoral Fellow (IPDF), IIT Bombay, India**
  4. **Dr. Shivalika Sharma, Postdoctoral Fellow, Asia Pacific Center for Theoretical Physics, POSTECH, Pohang, Korea**

## Publications Profile

- ❖ **Linear and Non-linear response of 2-D single carrier dots: Role of impurity perturbations, Ram Kuntal Hazra, Manas Ghosh and S. P. Bhattacharyya, Chem. Phys., 333, 18 (2007).**
- ❖ **Quantum Adiabatic Switching Route to the Impurity Modulated states of 2-D Quantum Dots With different switching functions, Ram Kuntal Hazra, Manas Ghosh and S. P. Bhattacharyya, Int. J. Quant. Chem., 108, 719 (2007).**
- ❖ **Modulation of the electronic states of 2-D single carrier quantum dots due to presence of hole doped impurity perturbations, Ram Kuntal Hazra, Manas Ghosh and S. P. Bhattacharyya, Chem. Phys., 344, 61 (2008).**
- ❖ **Information entropy and level spacing distribution based signatures of quantum chaos in electron doped 2D single carrier quantum dots, Ram Kuntal Hazra, Manas Ghosh and S. P. Bhattacharyya, Chem. Phys. Lett., 460, 209 (2008).**
- ❖ **Metastable impurity perturbed states of 2-D quantum dots, Ram Kuntal Hazra, Manas Ghosh and S. P. Bhattacharyya, Chem. Phys. Lett., 468, 216 (2009).**
- ❖ **A linear variational route to the polarizability of 2-D artificial atoms: effects of anharmonicity in the confinement potential, Manas Ghosh, Ram Kuntal Hazra and S. P. Bhattacharyya, Chem. Phys. Lett., 388, 337 (2004).**
- ❖ **Non-linear optical response of single carrier 2-D anharmonic Quantum dots, Manas Ghosh, Ram Kuntal Hazra and S. P. Bhattacharyya, Chem. Phys. Lett., 397, 258 (2004).**
- ❖ **Maximizing second hyperpolarizability of single carrier 2D quantum dots: Interplay of strengths of confining potential, magnetic field and anharmonicity, Manas Ghosh, Ram Kuntal Hazra and S. P. Bhattacharyya, Chem. Phys. Lett., 405, 410 (2005).**
- ❖ **Response of Energy Levels and Wavefunctions of 2-D Artificial Atoms to Changes in Parameters in the Hamiltonian, Manas Ghosh, Ram Kuntal Hazra and S. P. Bhattacharyya, J. Theo. Comp. Chem, 5, 25 (2006).**

- ❖ **Linear and Non-linear optical response properties of singlet 2-electron quantum dots, Manas Ghosh, Ram Kuntal Hazra and S. P. Bhattacharyya, Chem. Phys. Lett., 434, 56 (2007).**
- ❖ **Response Properties of 2-electron 2-D Quantum Dots: Triplet versus Singlet, Manas Ghosh, Ram Kuntal Hazra and S. P. Bhattacharyya, Computing Letters, 3, 183 (2007).**
- ❖ **Response Dynamics of 2-D Quantum Dots in the presence of time-varying Fields: Anharmonicity and Pulse shape effects, Manas Ghosh, Ram Kuntal Hazra and S. P. Bhattacharyya, Chem. Phys., 345, 103 (2008).**
- ❖ **Rabi Type oscillations in damped two-dimensional single electron quantum dots”, Madhuri Mukhopadhyay, Ram Kuntal Hazra, Manas Ghosh, Samaresh Mukherjee and Shankar P. Bhattacharyya, Cent. Eur. J. Phys., 10(4), 983 (2012).**

**Publications (FROM RESEARCH GROUP ONLY)**

- **“Exact spectra of strong coulomb correlations of 3-D 2-e harmonic dots in magnetic field”, P. Aggarwal, S. Sharma, H. Kaur, S. Singh, and R. K. Hazra, Physica E: Low- dimensional Systems and Nano-structures 85, 56 (2017).**
- **“Exact e-e (exchange) correlations of 2-D quantum dots in magnetic field: Size extensive  $N=3, 4$ , n-electron systems via multi-pole expansion”, P. Aggarwal, S. Sharma, S. Singh, H. Kaur and R. K. Hazra, Physica E: Low-dimensional Systems and Nano-structures 88, 26 (2017).**
- **“Multi-excitonic ( $N=1,2$  and 3) quantum dots in magnetic field: Analytical mapping of correlations (exchange) by multipole expansion” S. Singh, H. Kaur, S. Sharma, P. Aggarwal and R. K. Hazra, Physica E: Low-dimensional Systems and Nano-structures 88, 289 (2017).**
- **“Strongly Correlated Excitons of Regular/irregular Planar Quantum Dots in Magnetic Field: Size Extensive Bi- and Tri-Exciton (e-h-e-h and e-e-h/e-h-h) Systems by Multipole Expansion”, H. Kaur, S. Singh, P. Aggarwal, S. Sharma, S. Yadav and R. K. Hazra, Am. Chem. Soc. Omega 2,7410-7423 (2017).**
- **“Shell structure and paramagnetism of 3-D  $N$ -e anisotropic (ellipsoidal) quantum dots: Exact multi-pole expansion of coulomb interaction under fermionic exchange symmetry”, S. Sharma, P. Aggarwal, H. Kaur, S. Yadav and R. K. Hazra, AIP Advances, 8, 095116 (2018).**
- **“Addition energy and magnetization of 3-D multicarrier anisotropic quantum dots in magnetic field by exact multi-pole expansion of coulomb correlations”, S. Sharma, P. Aggarwal, H. Kaur and R. K. Hazra, Physica E: Low dimensional Systems and Nano-structures, 104, 206 (2018).**
- **“Binding energies and chemical potential of neutral and charged exciton-complexes of transition metal dichalcogenides/anisotropic 2-D quantum dots in magnetic field by exact multi-pole expansion of coulomb correlations”, H. Kaur, S. Sharma, P. Aggarwal and R. K. Hazra, Physica E: Low dimensional Systems and Nano-structures, 108, (2019).**

- “Exact formalism of strongly coulomb correlated 2-D N-e (N=2,3,4,5,6,...) quantum dots via multi-pole expansions: chemical potential and addition energy vs magnetic field”, P. Aggarwal, S. Sharma, H. Kaur, S. Yadav and R. K. Hazra, *Journal of Physics Communication*, 3, 035011 (2019).
- “Analytical treatment to Helium isoelectronic ions via Green function expansion of Coulomb interactions: perturbation calculations of ground-state energies with Hydrogenic orbitals”, S. Sharma, P. Aggarwal, H. Kaur and R. K. Hazra, *Journal of Indian Chemical Society*, 96, 775 (2019) (Special issue, Invited article from Indian Chemical Society).
- “Multi-electron anisotropic quantum dots/TMDCs/CNT families under magnetic field: analytical treatment to first Brillouin zone by Fermi liquid model”, P. Aggarwal, S. Sharma and R. K. Hazra, *Molecular Physics*, e1761472 (1-15) (2020) (Special issue, Invited article from German School of Chemistry).
- “Full-scale analytical perturbation calculation of He-isoelectronic series with Hydrogenic bound states via Green's function expansion (monopole) of Coulomb interactions”, S. Sharma, P. Aggarwal and R. K. Hazra, *Molecular Physics*, e1770881 (1-9) (2020) (Special issue, Invited article from German School of Chemistry).
- “Heavy-hole bilayer trions of transition metal dichalcogenides by analytical treatment to model He-isoelectronic ions upto dipole factor of Green's function expansion of Coulomb interaction”, S. Sharma, B. Kapil, P. Aggarwal and R. K. Hazra, *Physics Open*, 11, 100107 (2022).
- “Binding energies and current density of heavy-hole trions of monolayer transition metal dichalcogenides: analytical perturbation treatment of Coulomb interaction with 2D H-like basis set”, B. Kapil, S. Sharma, P. Aggarwal and R. K. Hazra, *Eur. Phys. J. Plus*, 137, 809 (2022).
- “Analytical multiconfiguration treatment to ground state and ionization energies of He-isoelectronic ions and and Period-II elements Coulomb Green's function for H-like orbitals, B. Kapil, S. Sharma, P. Aggarwal and R. K. Hazra (submitted to *ChemPhysChem*, Theoretical Chemistry Special issue).

Conference Organization/ Presentations (in the last three years)

#### National Conferences:

- ❖ Analytical multi-configuration variation method for ground-state and ionization energies of He and Period-II elements using Green's function expansion of Coulomb (exchange) interaction for H-like basis set, Theoretical Chemistry Meeting: Structure and Dynamics, IACS Kolkata, 26-29 May 2022.
- ❖ “Electronic structure of He-isoelectronic series: a comparative study between perturbation and multi-configuration variational approaches with analytical multi-pole integrals of Green's function expansion of Coulomb interactions”, 17th Theoretical Chemistry Symposium, IISER, Kolkata, December 11-14, 2021.
- ❖ “Multi-carrier systems in Lateral (Electrical) and Transverse (Magnetic) Confinements by Multi-pole Expansion: Atoms, Molecules to Superlattices.”, 16th Theoretical Chemistry Symposium, BITS Pilani, 14-17 February 2019.

**Poster presentations (National):**

- ❖ B. Kapil and R.K. Hazra, “Heavy-hole bilayer trions of transition metal dichalcogenides by analytical treatment to model He-isoelectronic ions upto dipole factor of Green’s function expansion of Coulomb interaction”, Theoretical Chemistry Meeting: Structure and Dynamics, IACS Kolkata, 26-29 May 2022.
- ❖ B. Kapil and R.K. Hazra, “Heavy-hole bilayer trions of transition metal dichalcogenides by analytical treatment to model He-isoelectronic ions upto dipole factor of Green’s function expansion of Coulomb interaction”, 17th Theoretical Chemistry Symposium, IISER Kolkata, 11-14 December 2021.
- ❖ H. Kaur and R.K. Hazra, “Binding Energies And Chemical Potential Of Neutral And Charged Exciton-Complexes Of Transition Metal Dichalcogenides/Anisotropic 2-D Quantum Dots In Magnetic Field By Exact Multi-Pole Expansion Of Coulomb Correlations”, 16th Theoretical Chemistry Symposium, BITS Pilani, 14-17 February 2019 ( **Best Poster award**).
- ❖ S. Sharma and R.K. Hazra, “Shell structure and paramagnetism of 3-D N-e anisotropic (ellipsoidal) quantum dots: exact multi-pole expansion of coulomb interaction under fermionic exchange symmetry”, 16th Theoretical Chemistry Symposium, BITS Pilani, 14-17 February 2019.
- ❖ P. Aggarwal and R.K. Hazra, “Exact Formalism of Strongly Correlated of 2-D N-e (N=2,3,4,5..) Superlattices via multipole expansion” in the 16th Theoretical Chemistry Symposium held at BITS Pilani, Pilani campus, 14-17 February 2019. (**Best Poster Award**)
- ❖ H. Kaur and R.K. Hazra, ‘Strongly correlated excitons of anisotropic 2-D quantum dots in magnetic field: Size extensive bi- and tri-exciton (e-h-e-h & e-e-h, e-h-h) systems by multipole expansion’ at the ACS Campus Road Show, 2018 at University of Delhi.
- ❖ H. Kaur and R.K. Hazra, ‘Strongly correlated excitons of regular/irregular planar quantum dots in magnetic field: Size extensive bi- and tri-exciton (e-h-e-h & e-e-h, e-h-h) systems by multipole expansion’ at the National Conference for Emerging Trends in Applied Sciences, 2017 at Galgotias University, UP.
- ❖ S. Singh and R.K. Hazra, ‘Multi Excitonic Quantum Dots in Magnetic Field: Analytical Mapping of Correlations by Multipole Expansion’ at National Conference on Emerging Trends in Applied Sciences, 2017 at Galgotias University, UP
- ❖ S. Sharma and R.K. Hazra, “Exact formalism of coulomb correlations via multipole expansion:3-D N-e (N≥3) anisotropic systems in magnetic field”, APCTCC8 2017
- ❖ P. Aggarwal and R.K. Hazra, “Exact formalism of strongly correlated 2-D N-e (N=2,3,4,5...) Superlattices via multipole expansion”, APCTCC8 2017
- ❖ P. Aggarwal and R.K. Hazra, “Exact e-e (exchange) correlations of 2-D quantum dots in magnetic field Size Extensive N=3,4..., n-electrons via multipole expansion”, TCS 2016, (**Prof. Charusita Chakravarty Memorial Best poster award**).
- ❖ S. Sharma and R.K. Hazra, “Exact spectra of strong coulomb correlations of 3-D 2-e harmonic dots in magnetic field”, TCS 2016 (**Prof. Charusita Chakravarty Memorial Best poster award**)
- ❖ P. Aggarwal, H. Kaur, S. Singh and R.K. Hazra, “An exact variation to condensed Fock-Darwin states at low temperature: Effect of magnetic field” , National symposium on Non-equilibrium statistical physics and Nonlinear Dynamics, IACS Kolkata, 2014

### **International Conferences/Poster Presentations:**

- ❖ “Exact e–e (exchange) correlations of 2-D quantum dots in magnetic field: Size extensive  $N=3,4,\dots, n'$ -electron systems via multi-pole expansion”, 4th Annual World Congress of Smart Materials-2018, Osaka, Japan, 6-8 March 2018.
- ❖ P. Aggarwal and R.K. Hazra, “Electronic spectra and chemical potential of 2-D multi-electron quantum dots in magnetic field: exact multi-pole expansion of coulomb correlation” in the 9<sup>th</sup> Molecular Quantum Mechanics Conference held at Heidelberg, Germany, July 2019 (**Best Poster Award**).
- ❖ S. Sharma and R.K. Hazra, “Shell structure and paramagnetism of 3-D  $N$ -e anisotropic (ellipsoidal) quantum dots: exact multi-pole expansion of coulomb interaction under fermionic exchange symmetry”, in the 9<sup>th</sup> Molecular Quantum Mechanics Conference held at Heidelberg, Germany, July 2019.
- ❖ Visited and delivered lecture, Prof. Henryk A. Witek’s research group, Department of Applied Chemistry, National Chaio Tung University, 30010 Hsinchu, Taiwan

### **Research Projects (Major Grants/Research Collaboration)**

- ❖ “Novel Approaches to Multicarrier Phenomena of Quantum Dots” SR/S1/PC-47/2012 by SERB (DST) (2013-2017).
- ❖ “Experimental studies and elucidation of tunneling mechanism of oxidative DNA mutation” DU-DST PURSE GRANT (2015-2018)

### **Awards and Distinctions**

- Dr. D. S. Kothari Postdoctoral Fellowship, (UGC, MHRD) September
- Rank-1, Appointment for the Post of Assistant Professor, Department of Chemistry, University of Delhi, 2010.
- Grade-II, Classical Guitar, Trinity College London, 94% (Distinction)

### **Association With Professional Bodies**

- Member, Department Research Committee (formerly).
- Member, Seminar Committee (formerly).

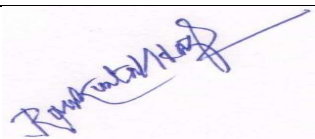
### **Other Activities**

- Workshop on “Development of Training Package in Chemistry at Higher Secondary Stage”, National Council of Educational Research and Training”, 2014
- “Field Trial and finalization of Training Package in Chemistry at Hr. Secondary Stage”, NCERT, 2014

### **My References**

- Prof. Shankar Prasad Bhattacharya  
Indian Association for Cultivation of Science, Kolkata-700032, West Bengal, India
- Prof. Debashis Mukherjee  
Indian Association for Cultivation of Science (Ex-Director), Kolkata-32, West Bengal, India  
Former Chairman, Raman Centre for Atomic Molecular and Optical Science, IACS, India  
Distinguished Chair Professor, Centre for Quantum Engineering, Research and Education, TCG CREST, India

- **Prof. Pratim Kumar Chattaraj**  
**Department of Chemistry, Indian Institute of Technology Kharagpur, West Bengal, India-721302**
- **Prof. Swapan Ghosh**  
**UM-DAE Centre for Excellence in Basic Sciences, "Nalanda", Opp Nano Sciences Building,  
University of Mumbai, Vidyanagari, Mumbai 400098, India**
- **Prof. Deb Shankar Ray**  
**Indian Association for Cultivation of Science, Kolkata-700032, West Bengal, India**

A handwritten signature in blue ink, appearing to read 'Pratim Kumar Chattaraj', is written on a light-colored background.

Signature of Faculty Member