# Dr. Mandeep Singh

*Department of Physics, IUST Awantipora, Jammu and Kashmir*

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## Research Interests

Computational imaging techniques, Optimization methods, Inverse problems, Quantitative phase measurement, Interferometry,Bio-imaging, Metrology, Digital holographic microscopy, Super-resolution microscopy

## Work Experience

### Islamic University of Science and Technology

*Awantipora, Jammu & Kashmir*

Assistant Professor, Department of Physics — *Nov. 2020 - Present*

Administrative roles/responsibilities: Warden Boys Hostel (from 21-07-2022 to present),
Additional roles/responsibilities: Departmental coordinators for: (Departmental Internal Quality Assurance (DIQA from 3rd Aug 2023), Internal Quality Assurance committee (IQAC from 3rd Aug 2023), Departmental Library Incharge (from 15-12-23), Research (from 12-4-22 to August 2023), Industrial connect (from 01-09-22 to 15-12-23), Internships and Training (08-12-2020), Center for Career Counseling and Placements (DPIC (for 3CP) from 16-06-22), Internshala Internship (08-02-2022), Co-curriculum activities(from 23-9-2021 to 15-12-2023), Sports (from 28-06-23 to 15-12-23), Student co-ordinator (from Sept.2023)), Physics Club
Other assignments: (Member of Departmental Purchase Technical Committee, Departmental Research Committee, and Departmental Discipline Committee(from 18-12-23))

### Layallpur Khalsa College of Engineering

*Jalandhar, Punjab*

Assistant Professor, Department of Applied Sciences — *2019 - 2020*

### Department of Physics, Indian Institute of Technology Delhi

*Delhi, India*

Ph.D. — *2012 - 2018*

My research work is in the area of computational imaging techniques used in interferometric phase measurement. Phase is required for quantitative (3D) imaging. In my thesis work, limits on information recovery in terms of resolution and accuracy both using a single interferogram (hologram) have been studied in detail. The study has resulted in a new patented optimization method that has overcome the limitations considered so far to be fundamental using conventional techniques with classical light interferometers. The new framework being general in nature, is applicable to range of applications. My research work includes demonstration of one such important application, digital holographic microscope (DHM). Additionally, I worked in a team involving biologists at ICGEB, Delhi and medical doctors associated to AIIMS, Delhi, and explored diagnostic applications using our DHM. The thesis work has been published in several high impact peer reviewed journals.

### Department of Physics and Technology, University of Tromsø, Norway

*Tromso, Norway*

Visiting Research Scholar under *UGC, India – SIU, Norway* student exchange program — *Sept. 2015 - Nov. 2015*

With Dr. Balpreet Singh Ahluwalia's Research Laboratory and studied super-resolution imaging technique: Structured Illumination Microscopy (SIM). The collaborative research work has resulted in an accurate and efficient computational technique to estimate the parameters used in SIM reconstruction algorithms.

### Engineering Physics Laboratory 2nd year, Physics Department, IIT Delhi

*Delhi, India*

Teaching Assistant — *2014 - 2016*

### Engineering Physics Laboratory 1st year, Physics Department, IIT Delhi

*Delhi, India*

Teaching Assistant — *2013*

## Education

### Department of Physics, Indian Institute of Technology Delhi

*Delhi, India*

Ph.D. research scholar — *July 2012 - July. 2018*

Thesis title: Interferometric phase imaging—New results and applications
Thesis supervisor: Dr. Kedar Khare

### Department of Physics, Panjab University

*Chandigarh, India*

Master of Physics (Honours School) [First Class] — *July 2009 - July 2011*

### Government College Hoshiarpur, Panjab University

*Hoshiarpur, India*

Bachelor of Science [First Class] — *July 2006 - July 2009*

## Honors & Awards

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|---|---|
| 2023 | **Research Fellowship**, awarded jointly by Indian Academy of Sciences **(IASc)**, Indian National Science Academy **(INSA)**, and The National Academy of Sciences India **(NASI)** |
| 2023 | **Selected for National Physics Olympiad Exposure Camp for Faculty 2023**, HBCSE, Tata Institute of Fundamental Research **TIFR**,Mumbai |
| 2023-2026 | **Research Grant (Principal Investigator)**, awarded by SERB SURE, Quantitative Phase Imaging System |
| 2023-2026 | **Research Grant (Co-Principal Investigator)**, awarded by SERB Core research grant, Study of Magnetic Properties of Perovskites using Artificial Intelligence |
| 2024-2025 | **Research Grant (Principal Investigator)**, awarded by JKSTIC, Digital Inline Holograpic Microscope for Cell Imaging |
| 2024-2025 | **Research Grant (Co-Principal Investigator)**, awarded by JKSTIC, Study of physical properties of Chalcogenide based compound semiconductors for solar cell applications |
| 2022 | **Distinction in Doctoral Research Award**, awarded by IIT Delhi |
| 2017 | **Gandhian Young Technological Innovation Award**, Research grant awarded by **BIRAC-SRISTI** at President of India's office for our work "Blood Quality Assessment Using Digital Holographic Microscopy" |
| 2016 | **Travel grant**, awarded by **DST**, **CSIR**, and **Optica (Formerly Optical society of America (OSA))** to present a research talk in USA |
| 2015 | **Travel and research grant**, awarded by UGC under Indo-Norwegian collaborative research student exchange programme to Norway |
| 2014 | **Senior Research Fellowship**, Awarded by Indian Institute of Technology Delhi |
| 2012 | **Junior Research Fellowship (JRF-NET)**, Awarded by Council of Scientific and Industrial Research (CSIR), India |
| 2012 | **Graduate Aptitude Test in Engineering**, Awarded by Indian Institute of Technology |
| 2012 | **Joint Entrance Screening Test**, Awarded by Science and Engineering Research Board |
| 2008 | **1st Prize**, Physics Quiz Competition (B.Sc.) |
| 2007 | **1st Prize**, Mathematical Quiz Competition (B.Sc.) |

## Patents and Publications

### Patent

- Kedar Bhalchandra Khare, Joby Joseph, Mandeep Singh, "Object image recovery from digital holograms, " WO2017103761 A1 (2017)

### Peer reviewed Journals

- M. P. Singh, M. Singh and K. Khare, "Single shot interferogram analysis for optical metrology," Appl. Opt. 53, 6713-6718 (2014)
- M. Singh, K. Khare, A. K. Jha, S. Prabhakar, and R. P. Singh, "Accurate multipixel phase measurement with classical-light interferometry," Phys. Rev. A 91, 021802(R) (2015)
- M. Singh and K. Khare, "Accurate efficient carrier estimation for single-shot digital holographic imaging," Opt. Lett. 41, 4871-4874 (2016)
- M. Singh and K. Khare, "Single shot interferogram analysis for accurate reconstruction of step phase objects," J. Opt. Soc. Am. A 34 349-355 (2017)
- M. Lahrberg, M. Singh, K. Khare, and B. S. Ahluwalia, "Accurate estimation of the illumination pattern's orientation and wavelength in sinusoidal structured illumination microscopy," Appl. Opt. 57, 1019-1025 (2018)
- M. Singh and K. Khare, "Single-shot full resolution region-of-interest (ROI) reconstruction in image plane digital holographic microscopy," J. Mod. Opt. 1-8 (2018)
- M. Singh, Tanu, "The revised locus of control scale: its reliability, validity and norms establishment," IJMER 10, 5(1) (2021)

### Conference Papers

- M. Singh and K. Khare, "Accurate single-shot full resolution digital holographic microscopy with ROI-reconstruction capability," in Digital Holography and Three-Dimensional Imaging, OSA Technical Digest (online) (Optical Society of America, 2017), paper W2A.10
- M. Singh and K. Khare, "Single shot high resolution digital holographic microscopy," in 12th International Conference on Fiber Optics and Photonics, OSA Technical Digest (online) (Optical Society of America, 2014), paper M4A.3
- K. Khare, S. Ali PT, M. Singh, and J. Joseph, "Single Shot High Resolution Digital Holographic Imaging," in Classical Optics 2014, OSA Technical Digest (online) (Optical Society of America, 2014), paper CM3D.3

### Supervision

- Master's Dissertation Students 6: Shahid and Benazir (2021), Arshad and Mehvish (2022), Tajjmula and Shahid (2023)
- Ph.D. (2 ongoing)

# Activities

**International Conference on ”Artificial Intelligence, Machine Learning and Intelligent Systems”** — *IUST*
Member, Technical committee — *October, 2023*

**Career Awareness training program delivered by Dr. Mohib Ul Haq, SKIMS, J&K under Industrial Connect, IUST** — *Rumi Library, IUST*
Coordinator — *5th September, 2023*

**Completed Faculty Development Program, Python with data analytics** — *Online DU*
Grade A+ — *August, 2023*

**National IP Awareness training program organised by CGPDTM and CSIR under Azadi Ka Amrit Mahotsav** — *IUST*
Participant — *21st July, 2023*

**Drawing, Painting, Slogan writing, and Poetry Competition based on Jal Shakti Abhiyan Catch the rain 2023 under the theme ”Source Sustainability for Drinking Water”** — *Department of Physics, IUST*
Coordinator — *20th June, 2023*

**Completed Two-week Interdisciplinary Refresher Course in ADVANCED RESEARCH METHODOLOGY** — *Online DU*
Grade A+ — *June, 2023*

**Research Scholar Interaction Program (Title: How to purse some serious research, including some international perspectives) by Prof. Yoshiro Azuma, Visiting Faculty to IIT Delhi from Sophia University Japan** — *Rumi Library, IUST*
Coordinator — *May, 2023*

**Completed One-week Faculty Development Program on Intellectual Property Rights** — *Online DU*
Grade A+ — *May, 2023*

**Faculty Interaction Program (Title: The culture of science and higher eductaion in Japan: Historical perspectives, current issues, and some comparisions to India) by Prof. Yoshiro Azuma, Visiting Faculty to IIT Delhi from Sophia University Japan** — *TEQIP Auditorium, IUST*
Coordinator — *May, 2023*

**National Science Day celebration** — *TEQIP Auditorium IUST*
Coordinator — *28th Feb., 2023*

**INSPIRE Program** — *IUST*
Organizing committee member — *14th December,2022*

**Special lecture by Prof. Yoshiro Azuma, Visiting Faculty to IIT Delhi from Sophia University Japan** — *Department of Physics, IUST*
Coordinator — *17th May, 2022*

**Completed two month course on FINANCIAL PLANNING: A PERSONAL FINANCE PROGRAMME** — *Online DU*
Grade A+ — *April, 2022*

**Completed course on Master the Fourier Transform and its applications** — *Online Udemy*
*April 2022*

**Completed course on Signal processing problems, solved in MATLAB and in Python** — *Online Udemy*
*April 2022*

**Intellectual Property Awareness training program organized by Intellectual Property Office, India** — *Online*
Participant — *April, 2022*

**Departmental Colloquim on "Relativity in 21st Century" by Prof. Ravishankar, Department of Physics, IIT Delhi** — *IUST*
Coordinator — *30th March,2022*

**INSPIRE: Catch them Young** — *IUST*
Organizing committee member — *28th-29th March,2022*

**International Workshop on , "Emerging trends based on artificial intelligence & Machine Learning in Food Processing"** — *IUST*
Participant — *23th-25th March,2022*

**Drwaing,Sketching, and Painting competition based on theme "World in 2050: A Scientific Perspective"** — *IUST*
Coordinator — *17th March, 2022*

**Completed Faculty Development Program on National Education Policy 2020** — *Online DU*
Grade A+ — *March, 2022*

**Completed Faculty Induction Program** — *Online DU*
Grade A+ — *January, 2022*

**Online lecture: 100 Years of Photoelectric Effect** — *Online*
Participant — *2021*

**Workshop on, "Air Traffic Management over Indian Airspace: Opeational Procedures and dynamic flow modelling"** — *Online, IUST*
Participant — *October 30, 2021*

**CONIAPS XXVII: 27th International Conference of International Academy of Physical Sciences on the theme 'Frontiers in Physics'** — *IUST*
Organizing committee member — *26th-28th Oct., 2021*

**eCourse on Startup Fundraising & Investments organized by GUSEC, TiE-Delhi NCR and Gujarat University** — *Online*
*2021*

**Completed Faculty Development Program: Latest Trends in Teaching Pedagogy** — *Jalandhar, India*
*2019*

**SIU, Norway–UGC, India sponsored Indo-Norway workshop, Optics and Photonics in Bio-sensing and Bio-imaging** — *Delhi, India*
Oral Presentation — *2017*
Structured illumination microscopy

**Digital Holography & 3-D Imaging** — *Jeju Island, South Korea*
Poster Presentation — *2017*
Accurate single-shot full resolution digital holographic microscopy with ROI-reconstruction capability

**Open House IIT Delhi** — *Delhi, India*
Poster Presentation — *2017*
Interferometric and Non-interferometric Phase Imaging

**1st Departmental Symposium on Advances in Physics** — *Delhi, India*
Poster Presentation — *2017*
Accurate Full Detector Resolution Reconstruction of Step Phase Object using Single Digital Interferogram

**SPIE Photonics West (BiOS Symposium)** — *San Francisco, United States*
Oral Presentation Accepted (could not be presented due to VISA delay) — *2016*
High Resolution Image Plane Digital Holographic Microscopy

**SIU, Norway–UGC, India sponsored Indo-Norway workshop, Optics and Photonics in Bio-sensing and Bio-imaging** — *Delhi, India*
Poster Presentation — *2015*
Structured illumination microscopy

**International Conference on Fibre Optics and Photonics** — *Kharagpur, India*
Poster Presentation — *2014*
Single Shot High Resolution Digital Holographic Microscopy

**5th Chandigarh Science Congress (CHASCON)** — *Chandigarh, India*
Poster Presentation — *2011*
Astronomy Through Virtual Telescope

**Optics and Photonics: Theory and Computational Techniques** — *Delhi, India*
*2017*

**International Conference on Optics and Optoelectronics** — *Dehradun, India*
*2014*

**Winter School on Photonics** — *Kolkata, India*
*2013*

**Workshop on Recent Advances in Photonics** — *Delhi, India*
*2013*

## Affiliation to Professional Bodies

**APS Physics: American Physical Society**
Member

**Optica (Formerly OSA Optical Society of America)**
Member

**Raman International Optronics Society (RIOS))**
Member

**IAPT(Indian Association of Physics Teachers)**
Member

**IPA(Indian Physics Association)**
Member

## Skills

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|---|---|
| **Programming** | MATLAB, GNU Octave, Fiji/ImageJ, LaTeX |
| **Operating Systems** | Microsoft Windows, Linux |
| **3D modelling** | Autodesk 123, SketchUp, used 3D printer |
| **Image Processing** | GIMP 2, Fiji/ImageJ, Adobe Photoshop |
| **Others** | SPSS statistics, complete package of LibreOffice, Microsoft Office etc. |
| **Languages** | English (scored band 8 in IELTS), Hindi, Punjabi |

## Extracurricular Activity

**Living Science** — *Delhi, India*
Volunteer Member — *2015 -*
Living Science is an initiative in the form of web series to promote Indian science

**Department of Physics, Panjab University** — *Chandigarh, India*
Class Representative — *2009 - 2010*

**Government College Hoshiarpur, Panjab University** — *Hoshiarpur, India*
Committee member — *2007 - 2009*
Helped to manage student activities like debates and quiz competitions, worked as tour coordinator, etc.

## Referees

**Dr. Kedar Khare** — *Delhi, India*
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**Dr. Sunita Srivastava** — *Haryana, India*
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**Dr. Tankeshwar Kumar** *Haryana, India*

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**Dr. Arun Anand** *Gujrat, India*

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