

DR. IMTIAZ AHMAD

Assistant Professor of Physics • University of Peshawar, Pakistan

Nanophysics | Microfluidics | Nanoparticle Self-Assembly | Surface & Interfacial Physics | Plasmonics

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23+

Years academic / research

44+

Peer-reviewed articles

23

First-author articles

11

Sole-author articles

2012-15

PhD • University of Twente

PI PROFILE

Research identity. Physicist working at the interface of nanophysics, microfluidics, surface physics and self-assembly. Research links particle shape, interfacial forces, evaporation, confinement and collective organization to experimentally measurable structures and optical response.

Research philosophy. Understand the mechanism. Teach the idea. Test the physics.

Teaching philosophy. Physics as a way of thinking—combining physical intuition, mathematical reasoning, research-informed teaching and student mentorship.

RESEARCH TRAJECTORY — ONE-GLANCE MAP

NANOROD SEPARATION	COFFEE-STAIN DYNAMICS	PURIFICATION & POPULATION	PLASMONICS & ENERGETICS	SURFACE INTERACTIONS	DIRECTED SELF-ASSEMBLY
shape-selective transport	evaporation-driven redistribution	rod/sphere fractionation	optical response & energy	AuNP-surface forces	anisotropic organization

RESEARCH EXPERTISE

NANOMATERIALS	PHYSICS / MECHANISMS	METHODS & CHARACTERIZATION
Gold nanorods; gold nanospheres; anisotropic nanoparticles; CTAB/citrate-stabilized AuNPs; mixed rod-sphere systems.	Evaporation; wetting; capillarity; surface/interfacial forces; energetics; particle population dynamics; self-assembly; confinement.	AFM; STM; HIM; HR-SEM; ellipsometry; zeta potential; centrifugation/purification; optical/plasmonic analysis; DDA/MLWA.

ACADEMIC FORMATION & APPOINTMENT

2012-2015	PhD in Physics — Nanophysics & Microfluidics University of Twente, The Netherlands
2000-2001	MSc Physics University of Peshawar • Second position in order of merit
2014	Casimir Research School — Nanochemistry for Nanophysicists Leiden University, The Netherlands
2002-present	University of Peshawar Academic career in Physics; current position: Assistant Professor

SELECTED RECENT PUBLICATIONS — RESEARCH RELEVANT TO NRPU DIRECTION

Year	Title	Journal	DOI
2026	How do citrate-stabilized AuNPs interact with surfaces? Experiment and theory	Colloids and Surfaces A, 728, 138691	10.1016/j.colsurfa.2025.138691
2025	Surface nanobubbles and nano gold assembly	Journal of Molecular Liquids, 127884	10.1016/j.molliq.2025.127884
2025	Optimizing CTAB-capped gold nanorod stability during centrifugation	Colloids and Surfaces A, 136235	10.1016/j.colsurfa.2025.136235
2025	Gold nanoshapes: a study on shape and energy reduction	Journal of Molecular Liquids, 126899	10.1016/j.molliq.2025.126899
2025	Dynamics of absorption peaks in plasmonic nanostructures	Colloids and Surfaces A, 136115	10.1016/j.colsurfa.2025.136115
2024	Purification of distinct nano shapes from mixtures of rods and spheres	Chemical Physics, 112572	10.1016/j.chemphys.2024.112572
2024	Assembly of nanoparticles at symmetric coffee stain locations	Colloids and Surfaces A, 682, 132833	10.1016/j.colsurfa.2023.132833
2024	Study of coffee stains for various nano concentrations	Journal of Materials Research	10.1557/s43578-024-01486-3
2024	Gold nano densities: relationship with drying parameters	Colloids and Surfaces A, 702, 135082	10.1016/j.colsurfa.2024.135082

TEACHING & STUDENT DEVELOPMENT

CORE PHYSICS	ADVANCED / SPECIALIZED	MENTORSHIP
Physics; Electromagnetic Theory; Materials Science.	Nanoscience & Nanotechnology; Laser Physics; Renewable Resources / Energy-related Physics; advanced nanophysics and microfluidics.	Research-informed teaching; student research training; experimental nanomaterials work; guidance in scientific problem formulation and interpretation.

SELECTED INDEPENDENT CONTRIBUTIONS

	CONTRIBUTION	PHYSICS / SIGNIFICANCE
01	Shape-selective nanoparticle separation	Developed/advanced understanding of separating distinct nanoparticle shapes from mixed rod-sphere populations.
02	Evaporation-driven assembly	Investigated coffee-stain formation, symmetric deposition and nanoparticle redistribution during droplet drying.
03	Stability & purification physics	Studied centrifugation-dependent stability and purification of CTAB-capped gold nanorods.
04	Plasmonic response & energetics	Connected nanostructure shape/energy with optical absorption behavior and plasmonic response.
05	Surface-mediated assembly	Examined citrate-stabilized AuNP interactions with surfaces and surface nanobubble-assisted assembly phenomena.

NRPU-RELEVANT RESEARCH CAPACITY

QUESTION	SYSTEM	MEASUREMENT	OUTCOME
How do particles organize?	Anisotropic AuNPs / mixed shapes	AFM • optical response • surface analysis	Mechanistic rules for directed assembly
How does drying reshape populations?	Evaporating nanoparticle droplets	Imaging • deposition analysis	Structure-process relationships
How do surfaces mediate assembly?	AuNPs + solid interfaces	AFM/STM • zeta potential • theory	Force/interaction framework

PROJECTS / FUNDING RECORD

The supplied academic record establishes substantial research and publication activity but does not provide verified project titles, durations, funding sources, award amounts or NRPU project IDs. These fields are intentionally not invented and should be inserted from official award/HEC records where applicable.

PI STATEMENT

Teaching and research form the center of my academic life. My work seeks to explain nanoscale organization through experimentally testable physics—linking particle shape, interfaces, fluid motion, evaporation, energetics and optical response. The resulting research environment is designed not only to generate publications, but also to train students to formulate physical questions, build evidence, and communicate mechanisms with scientific clarity.