

CURRICULUM VITAE

Ashwani K. Sharma, Ph.D., AFRL Fellow

Department of Electrical and Computer Engineering

School of Engineering | University of New Mexico

Albuquerque, NM 87131

I. PERSONAL & PROFESSIONAL DATA

Current Academic Rank: Lecturer III / Research Professor, Department of Electrical & Computer Engineering, University of New Mexico

Primary Professional Position: Supervisory Principal Electronics Engineer, Chief, RVBXC Ionospheric Impacts Section, Air Force Research Laboratory (AFRL/RVBX), Kirtland AFB, NM

Professional Honors: Fellow, Air Force Research Laboratory (AFRL, 2022)

Specialized Technical Competencies:

- Class 10 to Class 100 cleanroom fabrication and semiconductor microelectronics processing.
 - Quantum-ballistic transport in 1D and 2D nanoscale devices, strained heterostructures, and wide-bandgap semiconductors.
 - Advanced submicron and interferometric photolithography, electron-beam evaporation, thin-film dielectric/metal deposition, thermal oxidation, and ion implantation.
 - Radiation-hardened (Rad-Hard) electronics design and focal plane arrays for space satellite systems.
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II. EDUCATION

- **Doctor of Philosophy (Ph.D.) in Electrical Engineering**, 2004
University of New Mexico, Albuquerque, NM
Emphasis: Physics of semiconductor devices, semiconductor micro/nano electronics processing and fabrication, and advanced lithography.
Dissertation Focus: Scaling into the quasi-quantum regime and carrier transport in silicon nanofilms and nanowires.

- **Master of Science (M.S.) in Electrical Engineering**, 1994
University of New Mexico, Albuquerque, NM
 - **Bachelor of Science (B.S.) in Electrical Engineering**, 1990
University of New Mexico, Albuquerque, NM
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III. PROFESSIONAL EMPLOYMENT HISTORY

A. Academic Appointments — University of New Mexico

- **Lecturer III**, Department of Electrical and Computer Engineering (2016 – Present)
- **Research Professor**, Department of Electrical and Computer Engineering (January 2016 – Present)
- **Research Associate Professor**, Department of Electrical and Computer Engineering (2013 – 2016)
- **Research Assistant Professor**, Department of Electrical and Computer Engineering (2006 – 2013)
- **Research Associate**, Department of Electrical and Computer Engineering (1994 – 1997)
- **Graduate Research Assistant**, Department of Electrical and Computer Engineering (1992 – 1994)

B. Federal & Research Laboratory Appointments — Air Force Research Laboratory (AFRL)

- **Supervisory Principal Electronics Engineer & Chief**, Ionospheric Impacts Section (AFRL/RVBXC) (2023 – Present)
- **Senior Research Electronics Engineer**, GPS Technologies Branch (AFRL/RVBY) (2019 – 2022)
- **Senior Research Electronics Engineer**, Space Electronics Branch (AFRL/RVSE) (1999 – 2018)
- **Research Electronics Engineer**, Space Sensors Branch (AFRL/RVSS), Phillips Laboratory (1994 – 1998)

C. Industrial & Technical Experience

- **Engineering Intern**, National Research Laboratories Inc. (Fall 1991)
- **Avionics Engineering Intern**, Terra Avionics Inc. (Summer 1991)
- **Engineering Associate**, Garder Zemke Co. (1990 – 1991)

IV. HONORS, AWARDS, AND DISTINCTIONS

1. **AFRL/RVB Supervisory Award**, Air Force Research Laboratory (2026)
2. **Elected Fellow**, Air Force Research Laboratory (AFRL Fellow) (2022)
3. **Scientist & Engineer of the Year (Government Category)**, National Society of Asian Scientists and Engineers (SASE) (2022)
4. **AFMC Science, Engineering & Technical Management Career Achievement Award**, AFRL Space Vehicles Directorate (2022)
5. **AFRL Space Vehicles Directorate Group Cash Award** (\$1,000) (2016)
6. **AFRL Space Vehicles Directorate Best Publication Team Award** (Team Lead) (2015)
7. **AFRL Space Vehicles Directorate Individual Cash Award** (\$2,000) (2012)
8. **AFRL Space Vehicles Directorate Individual Cash Award** (\$1,000) (2011)
9. **Best Publication Award**, AFRL Space Vehicles Directorate (2010)
10. **Best Publication of the Year (Team Category, Lead Author)**, AFRL Space Vehicles Directorate (2010)
11. **Best Paper Award (Team Lead)**, IEEE International Symposium on Electronic System Design (ISED), Bhubaneswar, India (2010)
12. **AFRL Space Vehicles Directorate Individual Cash Award** (\$800) (2010)
13. **United States Air Force Nominee, Arthur S. Flemming Award** (Basic Research Category) (2008)
14. **AFRL Space Vehicles Directorate Individual Cash Award** (\$200) (2008)
15. **Best Paper Award (Lead Author)**, Journal of Applied Physics (Special Edition on High-Speed Devices) (2007)
16. **AFRL Space Vehicles Directorate Individual Cash Award** (\$2,000) (2007)
17. **AFRL Space Vehicles Directorate Individual Cash Award** (\$1,000) (2007)
18. **AFRL Space Vehicles Directorate Individual Cash Award** (\$700) (2007)
19. **Junior Scientific/Technical Achievement Annual Award**, AFRL Space Vehicles Directorate (2006)
20. **AFRL Space Vehicles Directorate Individual Cash Award** (\$1,500) (2005)

- 21. **AFRL Space Vehicles Directorate Individual Cash Award (\$1,000) (2005)**
 - 22. **AFRL Space Vehicles Directorate Certificate of Achievement Cash Award (\$150) (2005)**
 - 23. **AFRL Space Vehicles Directorate Time-Off Award (8 Hours, Nov 2005)**
 - 24. **AFRL Space Vehicles Directorate Time-Off Award (8 Hours, Sept 2005)**
 - 25. **AFRL Space Vehicles Directorate Time-Off Award (8 Hours, May 2005)**
 - 26. **AFRL Space Vehicles Directorate Individual Cash Award (\$500) (2004)**
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V. TEACHING & INSTRUCTIONAL EFFECTIVENESS

A. Statement of Teaching Philosophy & Pedagogical Approach

My commitment to instructional excellence rests on four fundamental pillars:

1. **Rigor and National Parity:** Developing complex course material delivered incrementally and logically, ensuring curricula match or exceed top-tier national engineering benchmarks while adhering strictly to ABET accreditation criteria.
2. **Bridge Between Theory and Semiconductor Device Fabrication Practice:** Providing students with real-world, hands-on fabrication experience in microelectronics processing, directly translating class-10/class-100 cleanroom practices into laboratory coursework.
3. **Industry and National Laboratory Relevance:** Liaising continuously with semiconductor industry partners and national laboratories (Sandia National Laboratories, AFRL) to equip students with current high-demand engineering competencies.
4. **Inclusive Student Success:** Actively fostering the next generation of engineers through accessible mentorship, undergraduate research pipelines, and creating supportive pathways for diverse student populations.

B. Summary of UNM Courses Taught (Over 55 Course Sections)

Consistently demonstrated instructional excellence with IDEA student evaluation scores ranging from **4.0/5.0** to **4.7/5.0**.

Term	Course Number	Course Title	Level	Evaluation Score
Fall 2026	ECE 574 /ECE 474 /NSME 574	Microelectronics Processing	Graduate	In session
Fall 2026	ECE 420	Senior Design II	Undergraduate	In session
Fall 2026	NSME 699	Dissertation	Graduate	
Spring 2026	ECE 576	Modern VLSI Devices	Graduate	4.33/5.0
Spring 2026	ECE 574/ ECE 474 /NSME 574	Microelectronics Processing	Graduate	4.4/5.0
Spring 2026	ECE 419	Senior Design I	Undergraduate	4.17/5.0
Fall 2025	ECE 574/ ECE 474 /NSME 574	Microelectronics Processing	Graduate	4.75/5.0
Fall 2025	ECE 420	Senior Design II	Undergraduate	3.75/5.0
Fall 2025	NSME 699	Dissertation	Graduate	
Spring 2025	ECE 576	Modern VLSI Devices	Graduate	5.0/5.0
Spring 2025	ECE 419	Senior Design I	Undergraduate	4.3/5.0
Fall 2024	ECE 574/ ECE 474 /NSME 574	Microelectronics Processing	Graduate	4.17/5.0
Fall 2024	ECE 420	Senior Design II	Undergraduate	
Spring 2024	ECE 576	Modern VLSI Devices	Graduate	5.0/5.0
Spring 2024	ECE 419	Senior Design I	Undergraduate	4.3
Fall 2023	ECE 574/ ECE 474 /NSME 574	Microelectronics Processing	Graduate	4.3
Fall 2023	ECE 420	Senior Design II	Undergraduate	4.75/5.0
Spring 2023	ECE 419	Senior Design I	Undergraduate	4.0/5.0
Spring 2023	ECE 576	Modern VLSI Devices	Graduate	
Fall 2022	ECE 420	Senior Design II	Undergraduate	5.0/5.0

Term	Course Number	Course Title	Level	Evaluation Score
Fall 2022	ECE 574/ ECE 474 /NSME 574	Microelectronics Processing	Graduate	
Spring 2022	ECE 419	Senior Design I	Undergraduate	4.2/5.0
Spring 2022	ECE 576	Modern VLSI Devices	Graduate	
Fall 2021	ECE 574/ ECE 474 /NSME 574	Microelectronics Processing	Graduate	4.22/5.0
Fall 2021	ECE 420	Senior Design II	Undergraduate	4.5/5.0
Spring 2021	ECE 576	Modern VLSI Devices	Graduate	4.0/5.0
Spring 2021	ECE 419	Senior Design I	Undergraduate	4.17
Fall 2020	ECE 574/ ECE 474 /NSME 574	Microelectronics Processing	Graduate	4.1/5.0
Fall 2020	ECE 420	Senior Design II	Undergraduate	
Spring 2020	ECE 576	Modern VLSI Devices	Graduate	4.2/5.0
Spring 2020	ECE 419	Senior Design I	Undergraduate	
Fall 2019	ECE 574/ ECE 474 /NSME 574	Microelectronics Processing	Graduate	4.1/5.0
Fall 2019	ECE 420	Senior Design II	Undergraduate	
Spring 2019	ECE 576	Modern VLSI Devices	Graduate	4.2/5.0
Spring 2019	ECE 419	Senior Design I	Undergraduate	
Fall 2018	ECE 574/ ECE 474 /NSME 574	Microelectronics Processing	Graduate	4.1/5.0
Fall 2018	ECE 420	Senior Design II	Undergraduate	
Fall 2018	ECE 595	Radiation Effects on Materials & Devices	Graduate	
Spring 2018	ECE 576	Modern VLSI Devices	Graduate	4.2/5.0
Spring 2018	ECE 419	Senior Design I	Undergraduate	

Term	Course Number	Course Title	Level	Evaluation Score
Fall 2017	ECE 574/ ECE 474 /NSME 574	Microelectronics Processing	Graduate	4.1/5.0
Fall 2017	ECE 420	Senior Design II	Undergraduate	
Spring 2017	ECE 576	Modern VLSI Devices	Graduate	4.2/5.0
Spring 2017	ECE 419	Senior Design I	Undergraduate	
Fall 2016	ECE 574/ ECE 474 /NSME 574	Microelectronics Processing	Graduate	4.1/5.0
Fall 2016	ECE 595	Advanced Junction Devices	Graduate	
Spring 2016	ECE 574/ ECE 474 /NSME 574	Microelectronics Processing	Graduate	4.1/5.0
Spring 2016	ECE 576	Modern VLSI Devices	Graduate	4.2/5.0
Fall 2015	ECE 595	Advanced Junction Devices	Graduate	
Fall 2015	ECE 574/ ECE 474 /NSME 574	Microelectronics Processing	Graduate	4.1/5.0
Spring 2015	ECE 576	Modern VLSI Devices	Graduate	4.2/5.0
Spring 2015	ECE 574/ ECE 474 /NSME 574	Microelectronics Processing	Graduate	4.1/5.0
Fall 2014	ECE 564	Guided Wave Optics	Graduate	4.5/5.0
Fall 2014	ECE 570	Optoelectronic Devices	Graduate	4.7/5.0
Spring 2014	ECE 576	Modern VLSI Devices	Graduate	4.2/5.0
Spring 2014	ECE 574/ ECE 474 /NSME 574	Microelectronics Processing	Graduate	4.1/5.0
Fall 2013	ECE 570	Optoelectronic Devices	Graduate	4.4/5.0
Spring 2013	ECE 574/ ECE 474 /NSME 574	Microelectronics Processing	Graduate	4.1/5.0

Spring 1997	EECE 472L	Semiconductor Processing Laboratory	Undergraduate	
Fall 1996	EECE 574L	Semiconductor Processing Laboratory	Graduate	

C. Curriculum & Course Development

- **ECE 419 /ECE 420 (Senior Design I & II)** Overhauled the undergraduate capstone sequence and redesigned undergraduate-level curricula for these two courses. Courses emphasize three core competencies: guiding students to construct rigorous engineering problem statements to solve complex technical challenges using foundational mathematics and science; executing holistic, standards-compliant system designs that explicitly evaluate safety, environmental impact, and public health considerations; and effectively articulating complex technical solutions and trade-offs through written deliverables and oral presentations tailored for diverse technical and non-technical audiences. Student progress is evaluated via structured milestone deliverables—including project charters (SOWs), prototypes, and formal defenses measured against targeted rubric thresholds based on IEEE standards to drive continuous curriculum improvement.
- **ECE 576 (Advanced Field Effect Devices / VLSI Devices):** Overhauled curriculum to incorporate time-response signal propagation modeling, nanoscale device physics, wrap-around gate architectures, and III-V / II-VI heterostructure HEMTs for high-speed computing.
- **ECE 574 / NSMS 574 & ECE 474 (Microelectronics Processing):** Redesigned the hands-on cleanroom laboratory project curriculum featuring complete small-group design, fabrication, parameter extraction, and electrical testing of MOS circuits.
- **ECE 595 (prior ECE 575) (Advanced Junction Devices):** Created and established curriculum covering advanced junction devices including VLSI transistors, SiGe and III-V HBTs, heterojunction HEMTs, high-level injection phenomena, and thyristors; transitioned from special topics into the permanent UNM catalog as ECE 575.
- **NSMS 650 (Advanced Research) & ECE 651 / 591 (Problems):** Formulated customized independent study curricula to support doctoral dissertation and master's thesis research.
- **Ph.D. Qualifying Examination Preparation:** Regularly formulated examination questions and evaluated doctoral candidate qualifying exams in microelectronics and optoelectronics core areas.

VI. STUDENT ADVISEMENT & MENTORSHIP

**** Important Administrative Note Regarding Advisory Roles:****

In accordance with evolving UNM ECE departmental policies regarding non-tenure track faculty serving as primary dissertation chairs, candidate advisement was conducted either directly (under departmental authorization) or in formal co-advisership with a tenured faculty member of record, wherein I served as the primary technical research advisor and mentor.

A. Ph.D. Dissertations (UNM Electrical & Computer Engineering)

1. **Scott Minas**, Ph.D. in NSME (Expected Graduation Fall 2027) — Committee Chair
2. **Paul Bisong**, Ph.D. in NSME (Expected Graduation Fall 2027) — Committee Chair
3. **Preyom Kanti Dey**, Ph.D. in Electrical Engineering (Spring 2020) — Committee Member
4. **Farhana Anwar**, Ph.D. in Electrical Engineering (Summer 2020) — Committee Chair
5. **Mirza Elahi**, Ph.D. in Electrical Engineering (Spring 2017) — Committee Chair
6. **Mohammad Uzzal**, Ph.D. in Electrical Engineering (Fall 2016) — Committee Chair
7. **Erin Vaughan**, Ph.D. in Nuclear Engineering (Summer 2016) — Committee Member
8. **Clay Scott Mayberry**, Ph.D. in Electrical Engineering (Spring 2016) — Committee Chair

B. Ph.D. Dissertation Committee Member (UNM ECE)

1. **Landon Schmucker**, Ph.D. in Electrical Engineering (2021)
2. **Noah Moreno**, Ph.D. in Electrical Engineering (2021)
3. **Farnood Mirkhosravi**, Ph.D. in Electrical Engineering (2018)
4. **Ryan Brooks**, Ph.D. in Electrical Engineering (2018)
5. **Nakka Meghanath**, Ph.D. in Electrical Engineering (2016) (Plus 15+ additional doctoral committee assignments across career)

C. Master's Theses & Projects Chaired / Primary Advisor (UNM ECE)

1. **Scott Minas**, M.S. in Electrical Engineering (Fall 2016) — Committee Chair
2. **Preyom Kanti Dey**, M.S. in Electrical Engineering (Spring 2015) — Faculty Advisor
3. **Lloyd P. Alego**, M.S. in Electrical Engineering (Spring 2015) — Faculty Advisor
4. **Rajesh Vasireddy**, M.S. in Electrical Engineering (Summer 2015) — Faculty Advisor
5. **Duncan McClure**, M.S. in Electrical Engineering (Summer 2015) — Faculty Advisor

D. Master's Examination Committee Member (UNM ECE)

1. **Caleb Glaser**, M.S. in Electrical Engineering (2021)
2. **Matt Johnson**, M.S. in Electrical Engineering (2021)
3. **Landon Schmucker**, M.S. in Electrical Engineering (2020)
4. **Ryan Colvin**, M.S. in Electrical Engineering (2020)
5. **Irma DeLaRocha**, M.S. in Electrical Engineering (2019)
6. **Rahul Jaiswal**, M.S. in Electrical Engineering (2019)
7. **Ethan Johnson**, M.S. in Electrical Engineering (2018)
8. **Hosuk Lee**, M.S. in Electrical Engineering (2017)
9. **Leon Wilson**, M.S. in Electrical Engineering (2017)
10. **Dmitrii Andreev**, M.S. in Electrical Engineering (2017)
11. **Jose Perez**, M.S. in Electrical Engineering (2016)
12. **Abdelrahman Elshafiey**, M.S. in Electrical Engineering (2016)

E. Postdoctoral Scholars Mentored (AFRL)

1. **Dr. Shima Nezhadbadeh**, UNM Postdoctoral Fellow (2019 – 2022)
2. **Dr. Thomas J. Rotter**, AFRL Postdoctoral Fellow (2016 – 2017)
3. **Dr. Andrii Iurov**, UNM Postdoctoral Fellow (2017 – 2020)
4. **Dr. Jose Mauricio Marulanda**, UNM Postdoctoral Fellow (2013 – 2016)
5. **Dr. Erin Vaughan**, National Research Council (NRC) Postdoctoral Fellow (2017 – 2019; subsequently transitioned to AFRL/RV permanent civil service)

F. AFRL Space Scholars Internships Mentored

1. **Stefania Esquer**, The University of Texas at El Paso (2021)
2. **Alexandra Fosness**, University of New Mexico (2021)
3. **Benjamin Fogg**, University of New Mexico (2020)
4. **Courtney Manbeck**, Cornell University (2020)
5. **Gabriel Oranday**, Explore Academy (2020)
6. **Ahmed Elshafiey**, University of New Mexico (2016)
7. **William Serrano**, University of Puerto Rico-Humacao (2016)

G. Air Force Summer Faculty Fellowship Program Mentored

1. **Dr. Prakashan Korambath**, University of California, Los Angeles (UCLA) (2002)
2. **Dr. Carl Vanhusden**, University of New Mexico (2000)
3. **Dr. Ashok Srivastava**, Louisiana State University (1999)

VII. SCHOLARLY & RESEARCH ACCOMPLISHMENTS

A. Summary of Research Program & Milestones

My basic and applied research focuses on nanoscale semiconductor quantum physics, carrier transport mechanisms in quasi-quantum and ballistic regimes, and developing space-qualified optoelectronic and microelectronic devices.

Nine Seminal Technical "World Firsts":

- 2025:** *PHYSICAL REVIEW B 111, 115302 (2025)*; in this research we established a unified, field-gauge-invariant quantum-kinetic theory coupled with Maxwell's equations to model ultrafast electron plasma dynamics in a quantum-wire system.
- 2021:** Demonstrated the effects of atomic-level modulation in orderly layered buckled 2D MoS₂ using Raman Spectroscopy for 500 GHz high-gain amplifier applications.
- 2020:** Demonstrated that quasi-particles/holes can travel faster than electrons in strained 1D silicon nanowires under high electric fields (*IEEE J. Quantum Electron.*, 2020).
- 2015:** Demonstrated that hole mobility exceeds electron mobility in thin 2D films scaled into the quasi-quantum regime (*J. Appl. Phys.*, 2015).
- 2015:** Demonstrated optimum THz pulse amplitude in low-temperature grown GaAs photoconductive switches for high-power, radiation-tolerant electronics.
- 2010:** Conceived and demonstrated the paradigm of carbon nanotubes (CNTs) for next-generation very large scale integration (VLSI) interconnects (*J. Nanophotonics*, 2010).
- 2007:** Discovered and characterized the effects of nanoscaling on the optical and electrical properties of crystalline silicon ultra-thin (<10 nm) films (*J. Appl. Phys.*, 2007 Best Paper).
- 2004:** Designed and fabricated the first truly wrap-around gate MOSFET architecture on Silicon-On-Insulator (SOI) substrate (*IEE Proc. Circuits Dev. Syst.*, 2004).
- 1993:** Designed and fabricated a novel method utilizing fluorine ion implantation to create localized energy states, enhancing visible and near-IR absorption in silicon MSM photodetectors.

B. Sponsored Research Grants & Sponsored Program Leadership

*Principal Investigator, Co-PI, and Lead on 28 sponsored research grants totaling 3.567M **, alongsidemanaging **50.25M in OSD Title III Programs and \$13.0M+ in Academic R&D Alliances.*

1. Competitive Government Research Grants (\$3.567M Total)

- 2024:** AFOSR, "Model for Ultrafast Carrier Scattering in Semiconductors," **\$120,000** Co-PI
- 2021:** AFRL/RV Innovative Research Proposal (IRP) Phase I, "Reduction in Defect Induced High-Electron Current Flow Instabilities in AlGaIn/GaN Nanowire Heterostructures," **\$92,500** (PI).

2020: Air Force Office of Scientific Research (AFOSR), *"Room-Temperature Quantum Ballistic Transport in Strain-Controlled Nanowire Devices," \$250,000* (Team Member).

2020: AFRL/RV IRP Phase I, *"Reduction in Defect Induced High-Electron Current Flow Instabilities in AlGaIn/GaN Nanowire Heterostructures," \$92,500* (PI).

2020: AFRL/RV IRP Phase I, *"Two Dimensional Group V Field Effect Devices Grown by Van Der Waals Atomic Layer Epitaxy," \$92,500* (PI).

2019: AFOSR, *"Tools for Test and Evaluation of Space Radiation Effects in Nanoelectronics," \$100,000* (Team Member).

2019: AFOSR, *"Room-Temperature Quantum Ballistic Transport in Strain-Controlled Nanowire Devices," \$250,000* (Co-PI).

2019: AFRL/RV IRP Phase I, *"Two Dimensional Group V Field Effect Devices Grown by Van Der Waals Atomic Layer Epitaxy," \$92,500* (PI).

2019: AFRL/RV IRP Phase I, *"Effects of Atomic-Level Modulation in Orderly Layered Buckled 2D Materials," \$92,500* (PI).

2018: AFRL/RV IRP Phase I, *"Effects of Atomic-Level Modulation in Orderly Layered Buckled 2D Materials," \$92,500* (PI).

2018: AFOSR, *"Tools for Test and Evaluation of Space Radiation Effects in Nanoelectronics," \$100,000* (Team Member).

2018: AFOSR, *"Room-Temperature Quantum Ballistic Transport in Strain-Controlled Nanowire Devices," \$250,000* (Co-PI).

2018: AFOSR, *"Photo-Response & Carrier Transport in III-V Semiconductor Quantum Wires for RF & Sensing," \$150,000* (Team Member).

2017: AFOSR, *"Photo-Response & Carrier Transport in III-V Semiconductor Quantum Wires for RF & Sensing," \$150,000* (Team Member).

2017: AFOSR, *"Room-Temperature Quantum Ballistic Transport in Strain-Controlled Nanowire Devices," \$250,000* (Co-PI).

2016: AFOSR, *"Photo-Response & Carrier Transport in III-V Semiconductor Quantum Wires for RF & Sensing," \$150,000* (Team Member).

2014: AFOSR, *"Electronic Band Structure for Efficient High Speed Classical & Quantum Electron Device Simulation," \$127,000* (Team Member).

2014: AFOSR, *"Semiconductor Nanowire Devices for High-Performance Electronic and Sensing Applications," \$120,000* (Team Member).

2014: Commander's Research and Development Fund (CRDF, joint with AFRL/RX), *"Bio-Devices Research," \$75,000* (RV PI).

2013: AFOSR, *"Semiconductor Nanowire Devices for High-Performance Electronic and Sensing Applications," \$120,000* (Team Member).

2013: CRDF (joint with AFRL/RX), *"Bio-Devices Research," \$75,000* (RV PI).

2013: AFOSR, *"Self-Assembly Electronics," \$100,000* (PI).

2012: AFOSR, *"Semiconductor Nanowire Devices for High-Performance Electronic and Sensing Applications," \$120,000* (Team Member).

2012: CRDF (joint with AFRL/RX), *"Bio-Devices Research," \$75,000* (RV PI).

2012: AFOSR, *"Self-Assembly Electronics," \$100,000* (PI).

2011: AFOSR, *"Self-Assembly Electronics," \$100,000* (PI).

2011: AFOSR, *"Nanowire MOSFETs," \$150,000* (PI).

2010: AFOSR, *"Nanowire MOSFETs," \$150,000* (PI).

2009: AFOSR, *"Nanowire MOSFETs," \$150,000* (PI).

2. Title III OSD / AT&L Strategic Programs Managed (\$50.25M Total)

2017 – 2019: MOU between AFRL/RV and OSD/AT&L, *"Complementary Electron Beam Lithography for Trusted ICs," \$9,400,000* (Project Lead).

2015: MOU between AFRL/RV and OSD/AT&L, *"Electron-Beam Direct-Write System Project," \$35,000,000* (Project Lead).

2014 – 2016: MOU between AFRL/RV and OSD/AT&L, *"Graphene-Based FLASH Memory," \$850,000* (Project Lead).

2013 – 2018: MOU between AFRL/RV and OSD/AT&L, *"Mask-less Electron-Beam Direct-Write System Development," \$5,000,000* (Project Lead).

3. Academic Research Alliances Led (\$12.357M Total)

2020 – 2022: AFOSR FA9550-21-1-0076, *"Fundamental Studies of InAlN/GaN HEMTs on Si Substrate,"* University of Delaware, **\$750,000** (Initiator & PI).

2015 – 2023: AFRL BAA-RVKV-2015-0002, *"Advanced Processing of Electronic Components for Space,"* UNM COSMIAC/CHTM, **\$8,000,000** (PI).

2018 – 2019: AFRL FA9453-17-C-0087, *"Effects of Atomic-Level Modulation in Orderly Layered Buckled 2D Materials,"* University of New Mexico, **\$385,000** (Initiator & PI).

2017 – 2019: AFRL FA9453-17-C-0087, *"Room Temperature Quantum Ballistic Transport in Strain-Controlled Nanowire Devices,"* University of New Mexico, **\$317,900** (Initiator & PI).

2014 – 2018: AFRL FA9453-15-1-0305, *"Environmental Testing 3D Electronics Research Program,"* UNM COSMIAC, **\$450,000** (Initiator & PI).

2009 – 2017: AFRL FA9453-10-1-0001, *"Characteristics of Charge Transport in Semiconductor Nano Devices and Structures,"* University of Missouri, **\$450,000** (PI).

2009 – 2017: AFRL FA9453-10-1-0002, *"Modeling and Experiment with Carbon Nanotubes for Applications in High Performance Circuits,"* Louisiana State University, **\$419,000** (Initiator & PI).

2009 – 2016: AFRL FA9453-10-1-0001, *"Modeling and Experiment with Compound Semiconductors for High Performance Circuits,"* University of Missouri, **\$310,000** (Initiator & PI).

2013 – 2015: AFRL FA9453-13-1-0220, *"Biological Nanoplatfoms for Integrated Molecular-Scale-Self-Assembled Electronics,"* University of New Mexico, **\$84,900** (Initiator & PI).

2012 – 2013: AFRL FA9453-13-1-0221, *"Unconstrained Heterogeneous Colloidal Quantum Dots Embedded in GaAs/GaSb Nanovoids,"* University of New Mexico, **\$100,000** (Initiator & PI).

1999 – 2008: AFRL Sponsored Research, *"Dimensional Nanoscaling Effects on the Optical and Electronic Properties of Semiconductor Devices,"* Louisiana State University, **\$250,000** (Initiator & PI).

1997 – 2011: AFRL Sponsored Research, *"Optical and Electronic Properties of Dimensional Scaling Semiconductor Materials into Nanometer Regime,"* UNM CHTM, **\$600,000** (Initiator & PI).

1997 – 2009: AFRL Sponsored Research, *"Effects of Field-Dependent Trapping/Detrapping in GaN Wrap-Around Gate Transistors,"* University of Missouri, **\$240,000** (Initiator & PI).

4. International Cooperative R&D Alliances (\$740K Total)

2013 – 2019: Joint RV-EOARD Grant, *"Inorganic Quantum Dots and Nanowire Devices,"* University of London, UK, **\$120,000** (Initiator & Lead).

2014 – 2016: AFRL Grant via EOARD, *"Bio-Inspired Top-Down Fabrication for Deep Submicron Circuits,"* Brunel University, UK, **\$60,000** (Initiator & Lead).

2012 – 2013: AFRL Grant via EOARD FA8655-10-1-3056, *"Nano Research Support,"* Brunel University, UK, **\$20,000** (Initiator & Lead).

2001 – 2012: Joint RV-EOARD Grant, *"Hybrid Organic and Inorganic Nanoscale Devices,"* Brunel University, UK, **\$275,000** (Initiator & Lead).

2009 – 2010: AFRL Fund Site Authorization to EOARD, *"Nano Research Support,"* University of London, UK, **\$20,000** (Initiator & Lead).

2003 – 2005: Joint RV-EOARD Grant No. 10-3056, *"Design of Novel Thin Film Transistors for Wearable Electronics,"* University of London, UK, **\$225,000** (Project Lead).

2003 – 2005: Joint RV-EOARD Grant No. 033070, *"Porous Semiconductor Growth,"* University of London, UK, **\$20,000** (Initiator & Lead).

C. Technology Transitions & Commercial Transfers

1. National Security & Space Systems Transitions (6 Transitions)

2011: Space-qualified radiation-hardened electronic components transitioned to the **Space Based Infrared System (SBIRS)** Program Office (~\$2B/yr program).

2010: Radiation-hardened electronics transitioned to the **Global Positioning System (GPS)** Program Office (\$1.8M/yr program).

2010: High-density radiation-hardened circuits transitioned to the **MILSATCOM** Program Office (\$860M/yr program).

2007: Multicolor Focal Plane Arrays transitioned to the **Space Tracking and Surveillance System (STSS)** Program Office (\$500M/yr program).

2007: Radiation-hardened electronics transitioned to the **STSS** Program Office.

2006: Focal Plane Array assemblies transitioned to the **SBIRS** Program Office (currently Overhead Persistent Infrared, OPIR).

2. Commercial Industry Technology Transfers (5 Transfers)

- **2019:** Gate-All-Around (GAA) Transistor Architecture and Modeling — Transferred to **IBM Corporation**.
- **2013:** Gate-All-Around Nanowire Transistor Architecture — Transferred to **Intel Corporation**.
- **2011:** Gate-All-Around Advanced Device Concepts — Transferred to **Taiwan Semiconductor Manufacturing Company (TSMC)** for processor roadmaps.
- **2001:** High-Speed Resonant Cavity Photodetectors — Transferred and licensed to **Hamamatsu Photonics**.
- **1998:** Enhanced Submicron MSM Photodetectors — Transferred and licensed to **New Focus Inc.**

3. *Space Flight Demonstrations Supported*

- **Navigation Technology Satellite 3 (NTS-3):** Team member delivering high-power, radiation-hardened RF amplifiers for the U.S. Air Force/Space Force's premier \$188M Vanguard satellite program (Endorsed by Maj Gen John E. Shaw, U.S. Space Force).
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VIII. PATENTS & INTELLECTUAL PROPERTY

- **U.S. Patent No. 5,691,563:** "*Silicon Metal-Semiconductor-Metal Photodetector*," S. R. J. Brueck, D. R. Myers, and **Ashwani Sharma**, Issued: November 25, 1997.
 - **U.S. Patent No. 5,449,945:** "*Method to Enhance Visible and Near-IR Performance of Si MSM Photodetectors*," S. R. J. Brueck, **Ashwani Sharma**, and D. R. Myers, Issued: September 12, 1995.
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IX. PUBLICATIONS & SCHOLARSHIP

A. Authored Books

1. Srivastava, J. M. Marulanda, Y. Xu, and **A. Sharma**, *Carbon-Based Electronics: Transistors and Interconnects at the Nanoscale*, CRC Press / Pan Stanford Publishing, 2015, 380 pages. ISBN: 978-981-4613-10-1.

B. Technical Reports

1. **Ashwani K. Sharma**, "*Room-Temperature Quantum Ballistic Transport in Strain-Controlled Nanowire Devices*," Air Force Research Laboratory Technical Report, AFRL-RV-PS-TR-2021-0003, Kirtland AFB, NM, 2021.
2. **Ashwani K. Sharma**, "*Advanced Electronics*," Air Force Research Laboratory Technical Report, AFRL-RV-PS-TR-2017-0114, Kirtland AFB, NM, 2017.

C. Refereed Journal Articles

1. Xuejun Lu, Danhong Huang, Godfrey Gumbs, Timothy T. Clark, and **Ashwani Sharma**, "Dynamics for unstable self-induced plasma field of electrons driven by a transient electric field in a quantum wire," *Physical Review B*, vol. 111, p. 115302, 2025.
2. Farhana Anwar, Andrii Iurov, Danhong Huang, Godfrey Gumbs, and **Ashwani Sharma**, "Scatter-enhanced tunneling and Klein-tunneling suppression in gapped graphene with chirality-time-reversal symmetry," *Journal of Physics: Condensed Matter*, vol. 33, no. 50, p. 505701, 2021.

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7. Erin I. Vaughan, Clay S. Mayberry, Danhong Huang, and **A. K. Sharma**, "Lattice-Mismatch Strain and Confinement in Nanoscale Si/SiO₂ Structures Fabricated Using Thermal Oxidation," *MRS Advances*, vol. 4, no. 10, pp. 583-589, 2019.
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11. Xinlu Chen, Ashok Srivastava, **Ashwani K. Sharma**, and Clay Mayberry, "Irradiation effect on back-gate graphene field-effect transistor," *SPIE Sensors and Systems for Space Applications X*, vol. 10196, p. 1019603, 2017.
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Ribbon Interconnect: A First Principle Study," *ECS Journal of Solid State Science and Technology*, vol. 6, no. 4, pp. P119-P124, 2017.

14. Chandana Pal, Lydia Sosa-Vargas, Jesus J. Ojeda, **Ashwani K. Sharma**, Andrew N. Cammidge, Michael J. Cook, and Asim K. Ray, "Charge transport in lead sulfide quantum dots/phthalocyanines hybrid nanocomposites," *Organic Electronics*, vol. 44, pp. 132-143, 2017.
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21. Biswanath Mukherjee, **Ashwani K. Sharma**, and Asim K. Ray, "Single Molecule Conduction: Brief Overview of Experimental Techniques and Theoretical Interpretations," *IET Circuits, Devices & Systems*, vol. 9, pp. 120-128, 2015.
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23. C. S. Mayberry, Danhong Huang, G. Balakrishnan, C. Kouhestani, N. Islam, S. R. J. Brueck, and **A. K. Sharma**, "Characterization of carrier transport properties in strained crystalline Si wall-like structures as a function of scaling into the quasi-quantum regime," *Journal of Applied Physics*, vol. 118, p. 134301, 2015.

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D. Refereed Conference Proceedings

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34. **Ashwani K. Sharma**, K. A. M. Scott, and J. C. Zolper, "Method to Enhance Visible and Near-IR Wavelength Absorption in Silicon," *Optical Society of America (OSA) Annual Meeting*, Toronto, Canada, 1993.
35. K. A. M. Scott, **Ashwani K. Sharma**, C. Wilson, and S. R. J. Brueck, "Large area 1D and 2D Si position sensors," *Optical Society of America (OSA) Annual Meeting*, 1993. (Plus 10 additional presentations in refereed conference proceedings).

X. PRESENTATIONS & INVITED LECTURES

A. Air Force Scientific Advisory Board (SAB) Briefings

2016 SAB Review: Invited Technical Briefer, "*Advanced Space Electronics Research.*"

2013 SAB Review: Invited Technical Briefer, "*Advanced Electronics and Device Miniaturization.*"

2004 SAB Review: Invited Technical Briefer, "*Electronic Structure of III-V Semiconductor Materials.*"

2004 SAB Review: Invited Technical Briefer, "*Nanotechnology Concepts for Space Satellites.*"

B. Senior Executive Leadership Briefings

1. **2018:** Dr. David Lam (Founder, Lam Research Corp., \$14.6B semiconductor equipment corporation) — Scaled nanoelectronics and e-beam direct-write technologies.
2. **2018:** Dr. Shashi Karna (Senior Technologist, ST, Army Research Laboratory).
3. **2017:** Dr. David Lam (Founder, Lam Research Corp.) — Direct-write lithography roadmaps.
4. **2016:** Dr. David Lam (Founder, Lam Research Corp.) — Nanotechnology collaboration.
5. **2015:** Dr. David Lam (Founder, Lam Research Corp.) — Nanoscale manufacturing.
6. **2015:** Dr. Shashi Karna (ST, Army Research Laboratory).

7. **2011:** Dr. Shashi Karna (ST, Army Research Laboratory).
8. **2008:** Dr. Shashi Karna (ST, Army Research Laboratory).
9. **1999:** Dr. Milton Cheng (Founder, New Focus Inc.) — Commercial licensing of dual-patent MSM photodetectors.
10. **1998:** Dr. Milton Cheng (Founder, New Focus Inc.) — Patent commercialization negotiations.
11. **1997:** Dr. Milton Cheng (Founder, New Focus Inc.) — Licensing of silicon MSM technology.

C. Selected Invited Non-Conference Technical Seminars (Selected from 40 Total)

1. **2021:** *"Fundamental Studies of InAlN/GaN HEMTs on Si Substrate,"* University of Delaware.
2. **2020:** *"Room-Temperature Quantum Ballistic Transport in Strain-Controlled Nanowires,"* AFOSR Program Review.
3. **2019:** *"A MoS₂-Graphene Electro-Absorption Modulator,"* Center for Integrated Nanotechnologies (CINT / Sandia National Laboratories).
4. **2018:** *"Lattice Mismatch Strain and Confinement in Nanoscale Si/SiO₂ Structures Fabricated Using Thermal Oxidation,"* MRS/AFRL Program Review.
5. **2017:** *"Light-Matter Interaction for Novel Quantum Materials in 2-D Van Der Waals Solids,"* Center for High Technology Materials (CHTM) / UNM.
6. **2016:** *"CMOS LC Voltage-Controlled Oscillator Design Using Carbon Nanotube Wire Conductor,"* Louisiana State University.
7. **2015:** *"Radiation Studies, Mobility and Transverse Electric Field Effects in Channel Conduction of Planar vs. Nanowire MOSFETs,"* Defense Threat Reduction Agency (DTRA) / UNM Review.
8. **2014:** *"Photo-Response and Carrier Transport in III-V Semiconductor Quantum Wires for High Performance RF and Sensing Applications,"* AFOSR Review.
9. **2013:** *"Metamaterial Electromagnetic Cloak at Microwave Frequencies,"* Manufacturing Engineering Department, University of New Mexico.
10. **2012:** *"Studies Related to Electronic Transport in Graphene for the Development of Graphene Technology and Superfast Computer Chips,"* Louisiana State University.
11. **2011:** *"Nanotemplate Arrays for Large-Scale Integration of Virus-Based Molecular Circuits,"* AFOSR Review.

12. **2010:** *"Integrating Fractals and Metamaterials as Embedded Antenna Systems and Conformal Surfaces,"* Center for High Technology Materials (CHTM).
 13. **2009:** *"Ballistic Transport Properties in Constricted Nanometer Paths,"* Center for High Technology Materials (CHTM).
 14. **2008:** *"Semiconductor Nanowire Devices for High-Performance Electronic and Sensing Applications,"* AFOSR Review.
 15. **2007:** *"Optical and Electronic Properties of Si Thin Films,"* Louisiana State University.
 16. **2006:** *"Nanoscaling Effects in Silicon Nanowires,"* School of Engineering, University of New Mexico.
 17. **2005:** *"Dimensional Scaling of Semiconductors into the Quasi-Quantum Regime,"* University of Campinas, Brazil (*International Seminar*).
 18. **2004:** *"Wrap-Around Gate MOSFET vs. Planar MOSFET,"* University of Missouri-Columbia.
 19. **2001:** *"MS2 Virus Confinement Characterization in Nanoscale Trench Structures,"* Army Research Laboratory.
 20. **1994:** *"Fluorine Ion Implantation to Enhance Speed and Quantum Efficiency in MSM Detectors,"* University of Saratov, Russia (*International Seminar*).
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XI. PROFESSIONAL SERVICE & LEADERSHIP

A. Professional Society Memberships & Fellow Status

- **Elected Fellow**, Air Force Research Laboratory (2022)
- **Member**, Optical Society of America (OSA) (1991 – 2006)
- **Member**, Society of Asian Scientists and Engineers (SASE)

B. Editorial Activities & Journal Reviewing

- **Guest Editor**, *IET Circuits, Devices & Systems* (European Journal), Special Edition on Quantum Dots and Nanowires (2007 – 2010)
- **Guest Editor**, Institute of Engineering & Technology (IET), Special Section on Nanoelectronics (2007 – 2010)
- **Technical Reviewer**, IEEE Transactions and Journals (2018 – 2021)
- **Technical Reviewer**, European Journal Institute of Engineering & Technology (IET Circuits, Devices, & Systems) (2007 – 2011)

C. Conference Organization, Symposia Leadership & Judging

- **Organizer**, Photodetector Sessions, Conference on Lasers and Electro-Optics (CLEO), San Francisco, CA (May 2004)
- **Organizer**, Nanomaterial Characterization Sessions, IEEE Conference on Nanotechnology, Maui, HI (October 2001)
- **Awards Judge**, Optoelectronic Devices, IEEE Nuclear and Space Radiation Effects Conference (NSREC), Reno, NV (July 2000)
- **Session Chair**, Photodetectors, Conference on Lasers and Electro-Optics (CLEO), Baltimore, MD (May 1999)
- **Session Chair**, Integrated Circuits, IEEE Nuclear & Space Radiation Effects Conference (NSREC), Snowmass, CO (July 1997)

D. Expert Reviewer for External Agencies & Institutions

- **Air Force Office of Scientific Research (AFOSR)** (2004 – Present)
- **IEEE Publications & Conferences** (2004 – Present)
- **National Science Foundation (NSF)** (2015 – Present)
- **Army Research Laboratory (ARL)** (2004 – 2013)
- **Naval Research Laboratory (NRL)** (2001 – 2009)
- **Missile Defense Agency (MDA)** (1995 – 2008)
- **Space and Missile Systems Center (SMC / Space Systems Command)** (1995 – 2013)
- **Advisor / Opportunity Sponsoring Mentor**, National Academy of Sciences / National Research Council (NRC) Research Associateship Program

XII. COMMITMENT TO DIVERSITY, EQUITY, INCLUSION, & COMMUNITY OUTREACH

Throughout my 28+ years of federal civil service and academic appointments, I have actively advanced inclusive excellence across educational and technical domains:

- **Merit-Based Opportunity & Equitable Recruitment:** Proactively recruiting and funding undergraduate, graduate, and postdoctoral scholars from underrepresented backgrounds through the and AFRL Space Scholars Program (Space Scholars and AFRL Scholars); UNM ECE Microelectronics Program, NSMS Graduate Program,
- **National Minority STEM Recognition:** Honored with the **2022 Society of Asian Scientists and Engineers (SASE) Engineer/Scientist of the Year Award**, recognizing measurable technical excellence coupled with dedicated STEM community mentorship.
- **Support for Minority-Owned & Historically Black Institutions:** Actively championed federal institutional programs providing research contracts, SBIR/STTR partnerships, and summer research access to historically underserved institutions, minority-owned small businesses, and underrepresented student researchers.
- **Institutional Alignment with *Lux Hominum Vita*:** Committed to UNM's core ethos ("Light of the Life of Man") by maintaining open laboratory doors, mentoring first-generation college students, and bridging state university education with premier national laboratory and semiconductor industry careers.

XIII. BIBLIOGRAPHY

2023 - Present: Supervisory Principal Electronics Engineer, Chief of the Ionospheric Impacts Section at the Air Force Research Laboratory

Presently Dr. Sharma leads the Ionospheric Impacts Section, managing a team of approximately 13 PhD scientists and engineers on critical DoD S&T programs in collaboration with international partners (UK, AU, CA, JP). His leadership focuses on advancing research and development efforts to address key national security challenges. Also serves as an instructor at ECE courses at the UNM as a Lecturer III.

2022: Senior Research Electronics Engineer, AFRL/RVBY

Dr. Sharma won the Society of Asian Scientists & Engineers Award in the government category and was the AFRL/RV nominee for the AFMC Science, Engineering & Technical Management Career Achievement award. Based on his many years of research, publication record and ability to continually bring funding on important AF programs he was chosen to become a Fellow of AFRL. Only 0.1% of AFRL Scientists and Engineers become AFRL Fellows. Also serves as an instructor at ECE courses at the UNM as a Lecturer III.

2021: Senior Research Electronics Engineer, AFRL/RVBY

Dr. Sharma devised a novel concentric GaN/InAlN device using quantum mechanical interface lattice mismatch strain to obtain low effective mass carriers capable of traveling at the ultimate group velocity. The quantum statistical calculations matched the experimental results proving that quasi-particles such as holes can travel at higher velocities than electrons in strained 1D nanowires under a strong electric field, thus capable of overcoming the intrinsic limitations that exist in 3D semiconductors. The applications of this basic research opened the door to meet the new strategic national security goals for RF broadband spectrum, identified RF spectrum vulnerabilities to jamming, and shifted to higher frequencies unattainable by adversaries. This technology development has the potential to exceed operations/s with a 102x reduction in power, 103x speed increase, and 10x in power density—increasing SWAP and dramatically improving on-orbit data processing, impacting comm., ISR, and SSA missions. Also serves as an instructor at ECE courses at the UNM as a Lecturer III.

2020: Senior Research Electronics Engineer, AFRL/RVBY

Dr. Sharma investigated experimentally and theoretically the ballistic transport properties of electrons through an optimized InAlN/GaN heterojunction quantum well channel of a HEMT device. Dr. Sharma's research focused on efficient scatter-less electron transport, which is necessary to obtain high signal quality, thermal stability, and linear gain at very high frequencies

(>214GHz) for high power (>400W) RF applications. This has the potential to exceed operations/s with a 102x reduction in power, 103x speed increase, and 10x in power density—increasing SWAP and dramatically improving data processing on orbit, directly impacting comm., ISR, and SSA missions. Also serves as an instructor at ECE courses at the UNM as a Lecturer III.

2019: Senior Research Electronics Engineer, AFRL/RVBY (Transferred from AFRL/RVSE)

Dr. Sharma transferred from the electronics branch (AFRL/RVSE) to GPS technologies (AFRL/RVBY). Through direct time-of-flight experiments, he proved that his electron transport model in the quantum-ballistic regime (based on Green's Function for time-response measurements for advanced 1-D & 2-D nano-developments) was accurate up to 95%. Additionally, based on his 2018 first-ever experiment to demonstrate the effects of energetic quasi-particles (holes), he proved that their velocity could exceed electron velocity in nanowires for 150GHz comm. applications; this validated his model and proved that "Einstein's relation" was not valid for 1D transport under a strong electric field. Dr. Sharma also wrote a winning innovative research proposal on *Group V Material for Field Effect Transistors Grown by Van Der Waals Atomic Layer Epitaxy* and authored 4 international refereed journal articles on advanced novel electronic devices. Also serves as an instructor at ECE courses at the UNM as a Lecturer III.

2018: Senior Research Electronics Engineer, AFRL/RVSE

Dr. Sharma developed the first-ever experiment to demonstrate the effects of atomic-level modulation in orderly layered buckled 2D Graphene/MoS2/Black-Phosphorous materials for 500GHz applications. These 2D devices have the potential for advanced electronics to operate at the theoretical carrier velocity max-limit (the group velocity) and would require 10x less power to operate. He also initiated experiments at CINT to fabricate tunable band-gap rad-hard phototransistors based on 1D and 2D nanoscales, spanning the technology into the 100GHz range. He authored 3 international refereed articles, including research on irradiation & plasma power effects on back-gate graphene FETs. Dr. Sharma wrote both an IRP proposal and an AFOSR proposal, both of which were selected for funding. Also serves as an instructor at ECE courses at the UNM as a Lecturer III.

2017: Senior Research Electronics Engineer, AFRL/RVSE

Dr. Sharma developed a theory/experiment demonstration to prove carrier transport in 2D Graphene/MoS2/Black-Phosphorous materials at the group-velocity limit to achieve cm/s, which is the theoretical maximum. He devised a group-velocity transport theory/model/experiment for 2-D nano-developments, spanning the technology into high-electron-mobility FETs for on-orbit

space-based data processing. Graphene/MoS₂/Black-Phosphorous-based nano-developments vastly improve space vehicle SWAP, enabling 10²-10³X in speed & in density for future electronics. He received \$250K/year for 3 years for Q-ballistic transport research. Additionally, he authored a Space Advisory Board (SAB) presentation and 4 international refereed journal articles, including a new physical phenomena and a review paper on molecular electronics. Also serves as an instructor at ECE courses at the UNM as a Lecturer III.

2016: Senior Research Electronics Engineer, AFRL/RVSE

Dr. Sharma designed the first-ever theory/experiment demonstration to prove new physical phenomena in the quasi-quantum regime where hole mobility exceeds electron mobility. Based on these experimental results, he devised a quantum-ballistic transport theory/model/experiment for heterojunction nano-devices, spanning technology into high-electron-mobility FETs that would greatly improve on-orbit computing power and speed. Dr. Sharma published 4 peer-reviewed journal articles (J. Appl. Physics, IEEE, European IET, J. Mat' Sci. & J. Phys Chemistry). He received the academic title of Research Professor at the UNM Electrical and Computer Engineering Department and was hired part-time (50%) as a Lecturer III in the same department. Also serves as an instructor at ECE courses at the UNM as a Lecturer III.

2015: Senior Research Electronics Engineer, AFRL/RVSE

Dr. Sharma devised semiconductor interface lattice-mismatch experiments and theory, spanning technology into high-electron-mobility transistors for space-based CPUs. He initiated experiments to develop novel junctionless nanowire rad-hard transistors. He led the RV nanotech R&D programs via in-house research and industry teams, including a \$33M program with Multibeam Co., a \$0.75M program with DigitalOptics Co., and various academic partners (Brunel Univ. U.K., UNM, LSU, CSU, U. of Missouri) and government stakeholders (EOARD, SMC, DTRA, RVSS) to design, fab, characterize, and model devices. Dr. Sharma engineered the first-ever experimental demonstration using Si/SiO₂ & GaAs/AlGaAs using a 3D selective thermal/growth process to exploit lattice-mismatch induced biaxial strain to achieve 10²x high electron/hole mobilities in nanoFET channels. Multibeam litho fabrication offered trusted rad-hard electronics for enabling on-orbit, reliable computing power. Engineered biaxial-strain in confined nanochannels reduces effective mass 10²x, enabling 10²x enhanced speed. He authored 5 international refereed journal articles (J. Appl. Physics, IEEE, Europhysics IET, J. Mat' Sci. & J. Phys Chem) in the area of nanosciences.

2014: Senior Research Electronics Engineer, AFRL/RVSE

Dr. Sharma configured the first-ever AlSb nanofilm devices for high-speed applications. He applied advanced selective growth techniques to fabricate nanotransistors and GaSb/AlSb nanofilm synthesis for radiation detection and as prospective switches for VLSI circuitry. He developed atomistic crystal growth experiments spanning material quality to advance directed self-assembled developments, and initiated experiments to develop novel AlSb quantum well rad-hard devices. Dr. Sharma was the lead author of 4 international refereed journal articles (IEEE, Europhysics Lett, Mat' Lett, & J. Phys Chemistry) in the area of nanotechnology. He also co-authored an NSF proposal with UNM/CSU/LSU.

2013: Senior Research Electronics Engineer, AFRL/RVSE

Dr. Sharma investigated synthesis and modeling experiments spanning molecular chemistry to advance quantum mechanical devices. He led experiments to develop GaAs/Al_xGa_{1-x}As based nanowire configuration transistors and developed ZnSe:Mn/ZnS and ZnSe:Cu/ZnS nanoparticle synthesis for directed self-assembly concepts using molecular affinities to configure prospective rectifiers-transistors for VLSI circuitry. He served as a Guest Editor of the European IET journal for the peer review of special edition annual manuscripts. He authored 6 refereed international journal articles in nanoscience, specifically in current transport and thermal effects in graphene, RF integrated circuits, and molecular directed self-assembly materials for ultra-dense electronic devices and circuits. He received the academic title of Associate Research Professor at the UNM Electrical and Computer Engineering Department.

2012: Research Electronics Engineer, AFRL/RVSE

Dr. Sharma developed atomistic affinity and modeling experiments spanning molecular chemistry to advance quantum-scale devices for computer logic circuitry. He led experiments to develop GaAs-based nanowires on selective growth for quantum devices and furthered VE research using biochemistry to fabricate nanoparticle-diodes-transistors for VLSI circuitry, vastly improving spacecraft SWAP and enabling 102-103X in speed and in density for electronic systems. AFOSR used his report to guide \$450K of investments into advanced electronic device and material development. He authored 7 refereed international journal articles in nanotechnology, specifically covering GaAs Nanowire Devices, carbon nanotube interconnects, graphene Field-Effect Transistors (FETs), directed self-assembly, and ultra-dense electronic devices and circuits.

2011: Research Electronics Engineer, AFRL/RVSE

Dr. Sharma established the first bio-virus-electronics (VE) directed self-assembly method using molecular “peptide” biochemistry necessary for electronics and characterization in collaboration with UNMH and the University of London, UK. He devised a TiO₂ electrodeposition technique to dramatically reduce trapped charge for space electronics applications and devised selective III-V growth for precise parameter control and reliability. He also led 2 teams to model and transition CNTs for rad-hard operations. Dr. Sharma developed the design and fabrication process for selective growth of III-V nanowires for rad-hard electronics, published two journal articles, and served as the PI for a \$300K AFOSR basic research grant on "Self-Assembly Electronics" and a \$450K AFOSR basic research grant on "Nanowire MOSFETs."

2010: Research Electronics Engineer, AFRL/RVSE

Dr. Sharma independently expanded novel bio-virus-electronics (VE) research by defining critical experiments to investigate chemical affinities between viruses and inorganic molecules critical for electronics and micrography characterization. He led university teams to develop, model, and transition CNTs for rad-hard operation and developed a process for the selective growth of III-V nanowires for rad-hard transistors used in space-based data processing. VE-based processors and memory offered a 100X reduction in power, over 100X increase in speed, and increase in density, vastly improving SWAP for Air Force satellites. Dr. Sharma published six journal articles, four conference papers, and served as a technical journal reviewer for the European Journal Institute of Engineering & Technology, IET Circuits, Devices, & Systems. He received the AFRL/RV's Best Publication Award and co-authored an IEEE Int'l Symposium (Bhubaneswar, India) Best Paper Award. He was the PI for a \$450K AFOSR basic research grant on "Nanowire MOSFETs" and a \$300K AFOSR grant on "Self-Assembly Electronics."

2009: Research Electronics Engineer, AFRL/RVSE

Dr. Sharma initiated groundbreaking research into “MS2 virus-based” electronics, developing critical experiments to determine affinities between MS2 viruses and peptides, and subsequently peptides and various metals/molecules. He conducted experiments to verify chemical affinities and characterization via SEM and TEM. Virus-based electronics offered an opportunity for self-assembled electronics with performance well beyond industry semiconductor roadmaps, which were limited by lithographic techniques. Nanowire-based electronics vastly improved the SWAP of satellite-based electronics. Dr. Sharma published four journal articles, three conference papers, and served as a technical journal reviewer for the European Journal Institute of Engineering & Technology, IET Circuits, Devices, & Systems. He was also the PI for a \$150K basic research grant from AFOSR on “*Nanowire Metal-Oxide-Semiconductor Field-Effect Transistor (MOSFET)s.*”

2008: Research Electronics Engineer, AFRL/RVSE

Dr. Sharma's research focused on random-access memory based on lead phthalocyanine (PbPc) diodes for high-speed data processing applications. He conceived analytical modeling equations describing electron transport in Carbon Nano-Tube-Transistors based on the dependence of the chiral vector and physical geometries, and developed devices based on CNTs for bio-sensing applications. Dr. Sharma fabricated random-access memory switches using 70nm thick spun films of PbPc molecules, with the on/off ratio for these single-layered devices. He published four journal articles, two conference papers, and served as a technical journal reviewer for the European Journal Institute of Engineering & Technology, IET Circuits, Devices, & Systems. For his high-quality research contributions, he was the Air Force nominee for the Arthur S. Flemming Award in the basic research category.

2007: Research Electronics Engineer, AFRL/RVSE

Dr. Sharma investigated DNA-based solid-state nanocrystalline TiO₂ diodes, conceiving electronic models for constricted films using advanced codes that included local field effects. He developed device and logic transfer characteristics for CNT (carbon nanotube) logic gates. These DNA-based devices increased memory density 100x to 1000x and enabled self-assembled circuits and fabrication beyond industry roadmaps. These revolutionary circuit fabrication concepts had the potential to increase circuit density 100-1000x. Dr. Sharma was the lead on one of four journal articles and published one conference paper. He was the lead author for the *Journal of Applied Physics* (Special edition of high-speed devices) article that received the Best Paper Award, and he became a technical journal reviewer over the next four years for the European Journal Institute of Engineering & Technology, IET Circuits, Devices, & Systems.

2006: Research Electronics Engineer, AFRL/RVSE

Dr. Sharma independently developed and led a diverse group of university and government researchers in the development of new electronic circuit capabilities based on the application of quantum mechanics in nanodevices. He formulated a new charge transport model that accurately predicts transistor performance and provides 95% accurate carrier transport information on kinetic energy to evaluate hot carrier effects, tunneling, and defect creation mechanisms to determine device reliability for critical dimensions approaching the ITRS ~22nm node. Dr. Sharma was the lead author on one of two journal articles. He received the academic title of Assistant Research Professor at the UNM Electrical and Computer Engineering Department.

2005: Research Electronics Engineer, AFRL/RVSE

Dr. Sharma performed pioneering imaging lithography research to enable dramatic circuit miniaturization into the nano-regime. He innovated and directed ground-breaking research to enable circuit miniaturization into quantum scales, using molecular self-assembly concepts to generate fundamental electronic structures/devices/circuits for the beyond-18nm node, in collaboration with Sheffield Hallam University (UK) in the highly challenging research area of 'bio-nano-electronics'. Dr. Sharma's work targeted future reliable comm/OCS/DCS systems with 10X reduced power and 100X increased bandwidths. He published two journal articles and was the lead on one of two conference papers.

2004: Research Electronics Engineer, AFRL/RVSE

Dr. Sharma independently developed an elastic-scattering conductivity physical model using the Green's function method for nanoscale devices. He performed pioneering research to investigate solutions to the complex lithography problem by experimentally researching self-assembly methods to generate basic electronic devices and circuits for extremely dense, low-voltage, low-power, and high-speed applications in collaboration with Sheffield Hallam University (UK) in the challenging field of molecular electronics (specifically DNA-based nanocomposites). Dr. Sharma was the lead author on the seminal high-impact factor journal article "*Mobility and transverse field effects on channel conductance in wrap-around-gate nanowire MOSFETs*" and completed his PhD degree.

2003: Research Electronics Engineer, AFRL/RVSE

Dr. Sharma, as the principal investigator in nanotechnology, developed a pioneering physical carrier conduction model to explain critical electron-hole transport in nanowires based on Coulomb blockade and drift-diffusion transport physics, enhancing field-dependent mobility for high-power, high-speed computing. He built a new business relationship with the nanoscience center of excellence at Sheffield Hallam University (UK) by proposing nanotechnology concepts to their faculty members, focusing on the synthesis of semiconductor nanoparticles for self-assembly device configurations to develop the next generation of high-performance processors for space. He continued working in the electronics laboratory and taking night classes in pursuit of his PhD.

2002: Research Electronics Engineer, AFRL/RVSE

Dr. Sharma developed a physical model (mathematical formula) based on fundamental Maxwell's equations to explain his groundbreaking experimental results on electron-hole pair generation mechanisms and the quantum efficiencies resulting from resonant cavity and

diffractive photon distribution effects in semiconductor periodic 1-D nanostructures. He was the lead author on the groundbreaking research paper “*Optical and electrical properties of nanostructured metal-silicon-metal photodetectors*” published in a high-impact factor IEEE journal of quantum electronics. Three separate international experts in the field gave Dr. Sharma excellent reviews on his publication. Dr. Sharma’s research contributions addressed DoD short- and long-term scientific/technological challenges by working at the atomic-quantum level, benefiting US Microsat technology with enormous potential to revolutionize future nanoelectronics as a dual-use technology. He continued working in the electronics laboratory and taking night classes in pursuit of his PhD.

2001: Research Electronics Engineer, AFRL/RVSE

Dr. Sharma established a nanoscience/nanotechnology innovative technical program for VS, which included specific (6.1) novel, challenging design/fabrication technical methods to create nanoscale semiconductor structures for novel device concepts. He independently built a new business relationship with DARPA/DSO by proposing a range of revolutionary concepts (such as virus MS2 isolation) as part of the molecular electronics program, securing \$800K from DARPA. He was the lead author on a seminal journal article and a co-author on a conference paper, for which his outstanding technical contributions were internationally honored, particularly by his United Kingdom peers at Sheffield Hallam University who nominated him for a Fellow of the European IET Society.

2000: Research Electronics Engineer, AFRL/RVSE

Dr. Sharma published one conference paper in the area of enhanced detection using a novel nanoscale patterning technique based on the concept of waveguide optics. He initiated a novel area of research in molecular-scale nanoelectronics, continued working in the optoelectronics laboratory, successfully passed his PhD qualifying exam, and continued taking night classes in pursuit of his PhD.

1999: Research Electronics Engineer, AFRL/RVSE

Dr. Sharma was the lead on one of two conference papers focused on *Radiation Tolerant Monolithic High-Speed Comm. Nanostructured Photodetectors*. He continued working in the electronics laboratory and took night classes in pursuit of his PhD.

1998: Research Electronics Engineer, AFRL/RVSS

Dr. Sharma continued working in the sensors & electronics laboratory, researching the effects of deep energy level defects in narrow-gap semiconductor materials and nanoscale semiconductor devices for Rad-Hard space applications.

1997: Research Electronics Engineer, AFRL/RVSS

Dr. Sharma was awarded a second patent for his work on high-speed photodetectors for space communications and near-IR enhanced target detection. He continued serving as an UNM research associate, teaching undergraduate semiconductor processing courses (EECE 472).

1996: Research Electronics Engineer, AFRL/RVSS

Dr. Sharma fabricated the first-ever GaN-based metal-semiconductor-metal high-speed photodetector, taught a graduate-level semiconductor fabrication and processing course (EECE 574) in the fall at UNM, and continued working as an UNM research associate.

1995: Research Electronics Engineer, AFRL/RVSS

In his first full year at AFRL, Dr. Sharma continued his work on ion-implantation-enhanced photodetectors and initiated a new research area in support of DARPA's global nuclear proliferation detection for solar-blind detectors using large-bandgap materials and thin films. He published one journal article, was awarded a patent for his work on IR spectrum enhanced photodetectors using his ion implantation method, and continued serving as an UNM research associate under the Intergovernmental Personnel Act of 1974.

1994: Research Electronics Engineer, AFRL/RVSS

After graduating from the University of New Mexico (UNM) with an MS in Electrical Engineering, Dr. Sharma began his federal employment at AFRL as an Electronics Engineer in the Space Sensors Division of the Phillips Laboratory (now AFRL/RVS). As a new hire, Dr. Sharma was the lead on two journal articles: one on enhanced photodetectors using a novel F-ion implantation method to create new energy states in the semiconductor, and another on adaptive optics dim target detection. He also co-authored two conference papers and became a research associate in the Electrical Engineering Department at UNM.