ZIJUN WANG

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SUMMARY

Electrical Engineering Ph.D. student developing near-field/mmWave MIMO and ISAC algorithms and validating them on reconfigurable 28-GHz SDR platforms. Experience spans OFDM signal processing, beam training, tracking and beamforming, sparse and Bayesian estimation, optimization, and end-to-end prototyping with USRP X410, phased arrays, and horn antennas. Seeking internships in wireless algorithms, systems, and research engineering.

EDUCATION

University at Buffalo, The State University of New York | Buffalo, NY — Aug. 2024 - Present
Ph.D. in Electrical Engineering, expected May. 2028; along-way M.S. in Electrical Engineering, Aug. 2026
GPA: 4.0/4.0 | Advisor: Prof. Rui Zhang

Nanjing University | Nanjing, China — Sep. 2020 - Jun. 2024
B.E. in Telecommunications Engineering, Jun. 2024
GPA: 4.52/5.00 (90.4/100) | Rank: 5/58

TECHNICAL SKILLS

Programming: Python, MATLAB, C/C++, Bash
Wireless and Signal Processing: 3GPP NR, Sionna RT, MIMO, OFDM, ISAC, beamforming, beam training/tracking, channel estimation, MUSIC, sparse recovery
Optimization and ML: CVXPY, semidefinite relaxation, ADMM, Gaussian processes, reinforcement learning, PyTorch, NumPy, scikit-learn
SDR and RF Systems: USRP X410, UHD 4.8, RFNoC, TMYTEK 28-GHz phased arrays, YTTEK frequency converters, horn antennas, AWG, oscilloscope, LabVIEW, Vivado

RESEARCH AND PROJECT EXPERIENCE

Hierarchical DRL for FAS Cross-Layer Control

UB OWIN Lab and WIRED Lab — *May. 2026 - Present*
Methods/Tools: PyTorch, Gymnasium, Stable-Baselines3, SMDP, PPO, hierarchical DRL

- Formulated joint fluid-antenna port selection, beamforming, pilot allocation, power control, and delay-sensitive user scheduling as a semi-Markov decision process with heterogeneous action durations.
- Designed a hierarchical policy structure that separates slower port/beam reconfiguration from faster PHY/MAC scheduling decisions across multiple control timescales.
- Developing Gymnasium/PPO environments that expose channel-estimation quality and FAS reconfiguration to both policy levels while linking physical-layer actions to queue evolution.
- Building training and evaluation pipelines to compare pilot overhead, transmit power, delay, and throughput against fixed-allocation and conventional scheduling baselines.

Reconfigurable 28-GHz MIMO Communication and Sensing Testbed

UB OWIN Lab | Industry collaboration with MediaTek — *May. 2025 - Present*
Methods/Tools: USRP X410, UHD 4.8, MATLAB, TMYTEK phased arrays, horn antennas

- Built an end-to-end 28-GHz platform integrating a USRP X410, TMYTEK 8 x 8 DUO phased arrays, YTTEK frequency converters, and horn-antenna RF front ends.
- Configured management and high-rate data interfaces for stable baseband streaming, waveform replay, synchronized acquisition, and repeatable communication and sensing measurements.
- Developed MATLAB/UHD automation for SDR and RF configuration, programmable waveforms, antenna mappings, transmit/receive beam weights, codebook sweeps, calibration, data capture, and offline processing.
- Enabled phased-array, horn-antenna, and hybrid transmit/receive configurations so the same baseband pipeline can support communication, channel sounding, beam training, and radar sensing experiments.
- Established repeatable SISO, SIMO, MISO, and RF-chain-limited MIMO workflows with configurable measurement sequences and reference-signal processing.

RESEARCH AND PROJECT EXPERIENCE (CONTINUED)

Near-Field Beam Training, Tracking, and Beamforming

UB OWIN Lab | Industry collaboration with MediaTek *Aug. 2024 - Present*

Methods/Tools: Python, MATLAB, XL-MIMO, OFDM, Gaussian processes, sparse recovery, ADMM

- Developed a unified narrowband and wideband near-field workflow for XL-MIMO/OFDM beam acquisition under on-grid, off-grid, and coherent multipath channels using DFT, Fresnel, and wide-beam codebooks.
- Derived DFT/Fresnel beam-pattern relations for low-complexity angle-range estimation and implemented amplitude-only refinement under a Rician measurement model.
- Implemented low-overhead multipath training through multi-beam compression, sparse phase retrieval, kernelized GP-UCB probing with adaptive selection, Rician-SPARTA recovery, and TV-regularized ADMM with least-squares debiasing.
- Built polynomial-trajectory beam tracking with sliding-window MLE/Adam updates and Fisher-information-guided, Thompson-style probe selection to adapt pilot beams under state uncertainty.
- Designed analog, hybrid, and digital wideband beamformers using PCA and projected-gradient alternating optimization, correlation-based subcarrier grouping, per-group least squares, and multi-user zero forcing.
- Mapped the algorithms to 3GPP NR beam management through SSB/CSI-RS sweeping and refinement, SRS sounding, Type-I/II codebook precoding, CQI/RI/PMI feedback, and PF/GBR scheduling interfaces.

Digital-Twin-Assisted Tracking and Beamforming for Near-Field ISAC

UB OWIN Lab | Industry collaboration with MediaTek *Jan. 2026 - Present*

Methods/Tools: Python, CVXPY, Sionna RT, PMBM-GGIW tracking, semidefinite optimization

- Built a closed-loop near-field ISAC simulator that refreshes a wireless digital twin through live sensing and uses the updated scene representation for subsequent communication and sensing decisions.
- Coupled PMBM-GGIW multi-target tracking with Sionna RT and converted posterior states into UE communication regions, extended-target sensing-support regions, and undetected-object exploration regions.
- Sampled the uncertainty regions to create channel point clouds and formulated robust beamforming programs with UE SINR, point-wise sensing-gain, exploration, and total-power constraints.
- Designed effective-rank target grouping and rank-aware scheduling; comparative and blockage studies improved robust sensing support, reduced sensing-rank burden, and maintained communication rates above their targets.

Ambiguity-Free FAS, Sparse-MIMO, and OFDM Sensing

UB OWIN Lab *May. 2026 - Present*

Methods/Tools: MATLAB, near-field ISAC, polynomial-phase sampling, virtual arrays, MUSIC

- Investigated nonunique parameter recovery caused by sparse spatial sampling, array geometry, and phase wrapping in near-field fluid-antenna and time-frequency sensing measurements.
- Established a unified polynomial-phase model that maps fluid-antenna port coordinates and OFDM reference-signal indices to common ambiguity and identifiability conditions.
- Derived closed-form uniqueness guarantees and constructive port-placement and sparse virtual-array designs subject to finite aperture and minimum inter-port-spacing constraints.
- Jointly designed sector-aware transmit/receive codebooks and beamspace MUSIC processing for compressed multi-target sensing with limited RF chains.

Federated Adapter Tuning for Vision-Language Foundation Models

UB OWIN Lab and GRADIENT Lab *Aug. 2025 – Aug. 2026*

Methods/Tools: PyTorch, federated learning, PEFT, ViLT, CLIP, Dirichlet non-IID data

- Implemented layer-wise parameter-efficient adapter tuning for ViLT and CLIP with configurable placement, selective aggregation, personalized classifier heads, and user/cluster-level adapters.
- Built a checkpointed federated pipeline with Dirichlet non-IID partitioning and periodic global aggregation, scaling experiments to 40 users and 5 GPUs.
- Evaluated adapter placement, architecture, and bottleneck capacity across more than 10 datasets using accuracy, convergence speed, and communication cost.

PUBLICATIONS AND MANUSCRIPTS

Published Journal Articles

[J1] Z. Wang, S. Tsai, R. Kiran, and R. Zhang, "Precise Near-Field Beam Training With DFT Codebook Based on Amplitude-Only Measurement," *IEEE Trans. Wireless Commun.*, vol. 25, pp. 14503-14516, 2026.

[J2] Z. Wang, M. Nivetha A, Y. Hu, and R. Zhang, "Compressive Beam-Pattern-Aware Near-Field Beam Training via Total Variation Denoising," *IEEE Wireless Commun. Lett.*, vol. 15, pp. 2914-2918, 2026.

Published Conference and Workshop Papers

[C1] Z. Wang, R. Kiran, S. Tsai, and R. Zhang, "Low-Complexity Near-Field Beam Training With DFT Codebook Based on Beam Pattern Analysis," *Proc. IEEE GLOBECOM*, pp. 5284-5289, 2025.

[C2] Z. Wang, R. Kiran, J. Nair, C.-H. Chen, T.-H. Chou, S. Tsai, and R. Zhang, "Sparsity-Aware Near-Field Beam Training via Multi-Beam Combination," *Proc. IEEE GLOBECOM*, pp. 2795-2800, 2025.

[C3] Z. Wang, A. Omer, N. Mastronarde, J. Chakareski, and R. Zhang, "Cross-Layer Design for Near-Field mmWave Beam Management and Scheduling Under Delay-Sensitive Traffic," *NeurIPS AI4NextG Workshop*, 2025.

[C4] J. Liu, **Z. Wang**, S. Tsai, and R. Zhang, "Efficient Near-Field Beam Tracking via Thompson Sampling," *Proc. Asilomar Conf. Signals, Syst., Comput.*, 2026.

[C5] J. Liu, **Z. Wang**, and R. Zhang, "Efficient, Adaptive Near-Field Beam Training Based on Linear Bandit," *Proc. IEEE MILCOM Workshop*, 2026.

Journal Manuscripts Under Review or Submitted

[J3] Z. Wang and R. Zhang, "GP Bandit-Assisted Two-Stage Sparse Phase Retrieval for Amplitude-Only Near-Field Beam Training," *IEEE Trans. Wireless Commun.*, under review, 2026.

[J4] Z. Wang, J. Liu, J. Ren, T.-H. Chou, S. Tsai, and R. Zhang, "Uncertainty-Aware Point-Cloud Beamforming and Rank-Aware Scheduling for Dynamic Digital-Twin Maintenance in Near-Field ISAC," *IEEE J. Sel. Areas Commun.*, under review, 2026.

[J5] J. Liu, **Z. Wang**, and R. Zhang, "Model-Aware Pilot-Efficient Near-Field Beam Tracking via Thompson Sampling," *IEEE Trans. Wireless Commun.*, under review, 2026.

[J6] Z. Wang, J. Liu, S. Tsai, and R. Zhang, "Unified Closed-Form Design Criteria for Fluid-Antenna and OFDM Sensing in ISAC," *IEEE Trans. Wireless Commun.*, submitted, 2026.

[J7] P. Abdisarabshali, **Z. Wang**, W. Mou, N. Mastronarde, R. Zhang, and S. Hosseinalipour, "Fine-Tuning Federated Foundation Models Over Resource-Constrained Wireless Networks: A Generalization-Personalization Balancing Perspective," *IEEE Trans. Wireless Commun.*, under review, 2026.

Conference Manuscripts Submitted

[C6] Z. Wang, J. Liu, S. Tsai, and R. Zhang, "Closed-Form Port Placement With Ambiguity Guarantees for Near-Field Fluid Antenna Sensing," *IEEE ICC 2027*, submitted.

[C7] Z. Wang, J. Liu, S. Tsai, and R. Zhang, "Closed-Form Ambiguity-Free Array Construction and Joint Sector-Aware Beamspace MUSIC for RF-Chain-Limited Sparse MIMO Virtual Arrays," *IEEE ICC 2027*, submitted.

HONORS

Graduate School Fellowship, University at Buffalo *(University-wide fellowship for outstanding Ph.D. students)* *Aug. 2024*
Chenxue Overseas Graduate Study Scholarship, Nanjing University *(Top 1%)* *Jun. 2024*
Outstanding Graduate, Nanjing University *Jun. 2024*

SERVICE AND TEACHING

Reviewer: IEEE Transactions on Communications; IEEE Transactions on Wireless Communications; IEEE Wireless Communications Letters; IEEE Communications Magazine; IEEE Transactions on Cognitive Communications and Networking; IEEE Transactions on Mobile Computing; IEEE Internet of Things Journal.

Subreviewer: IEEE Transactions on Signal Processing; IEEE Journal on Selected Areas in Communications; IEEE GLOBECOM (2025-2026); IEEE ICC (2026); IEEE MILCOM (2027); IEEE SECON (2026).

Teaching Assistant: EE 311 Electronic Devices and Circuits II, Spring 2025, University at Buffalo.
EE 305 Applied Probability Theory, Fall 2024, University at Buffalo.