XIAOLAN XU

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EXPERTISE

With over ten years of experience in applied electromagnetics and Earth remote sensing, she is an established expert in microwave remote sensing forward modeling, retrieval algorithm development, and GNSS reflectometry. Her work concentrates on enhancing the understanding of electromagnetic wave propagation and scattering across diverse terrestrial environments, including snow-covered terrains, vegetated land surfaces, and various soil condition. As a key member of renowned missions under NASA and the Canadian Space Agency, she has demonstrated a strong track record in leading research initiatives, crafting innovative remote sensing products, and securing substantial research funding. Her commitment to advancing global environmental monitoring is evidenced by her influential roles on various scientific teams, where she spearheads the integration of cutting-edge technologies and methodologies into satellite missions.

EDUCATION

Ph. D. / M. S. in Electrical Engineering, **University of Washington,** *Seattle, WA, USA* 12/2011
Bachelor of Engineering in Electrical Engineering, **Zhejiang University,** *Hangzhou, Zhejiang, China* 06/2006

- Member of Chu Kochen Honors College (Top 5% students, Honors Program of Engineering)

HONORS/AWARDS

- Featured Article in IEEE transactions on Antennas and Propagation for 2024 Women's Day 2024
- Team Award, to SMAP SDS transition of forward stream science data processing to the cloud 2024
- 2020 URSI Santimay Basu Prize, Citation: "For Developments in Wave Propagation and Scattering in Dense Random Media with Applications to Microwave Remote Sensing of Snow." 2020
- 2018 IEEE Antennas and Propagation Society Ulrich L. Rohde Innovative Conference Paper Awards on Computational Technique in Electromagnetics 2018
- Top reviewers in Multidisciplinary 2018
- Group Achievement Award, NASA Honors Award, SMAP Science and Cal/Val Team 2016
- Team Bonus Award, Algorithm and Science Data System Team, JPL 2016
- Team Bonus Award, Soil Moisture Active and Passive Mission Science Algorithm Team, JPL 2014

PROFESSIONAL EXPERIENCE

Jet Propulsion Laboratory, *Pasadena, CA, USA* 02/2014 - present
Scientist, Engineering & Science Directorate

- **Surface Deformation and Change Architecture study:** strategic planning for the next decadal survey, offering insights into utilizing future SAR missions (not limited to SDC) to support hydrology applications.
- **Lead Developer**, Freeze/Thaw Algorithm (L2/3-FT Product): Spearheaded the development of the freeze/thaw algorithm for NASA's Soil Moisture Active Passive (SMAP) satellite mission, enhancing data accuracy and application.
- **SMAP Mission Support**: Contributed to various SMAP field campaign data analyses and supported the development of optional algorithms and data cubes (L2-SM-A) for the SMAP satellite mission.
- **Reflectance Estimation from Bistatic Scattering**: Innovated methods to estimate reflectance through bistatic scattering of digital communication satellite Signals of Opportunity (SoOps) across the microwave spectrum from VHF to Ka band. Coordinated the SoOp Field Campaign, which included equipment deployment, hardware assembly, and ground measurement sampling.
- **Radar Tomography Algorithm Development for Snow Cover**: Developed the theoretical framework and retrieval algorithm for radar tomography of snow cover, serving as the Principal Investigator (PI).
- **Soil Moisture Product Development for CYGNSS**: Created the JPL Level 3 soil moisture product for the Cyclone Global Navigation Satellite System (CYGNSS), holding the role of Principal Investigator (PI).

Jet Propulsion Laboratory, *Pasadena, CA, USA* 01/2012-02/2014
Postdoctoral Fellow, Engineering & Science Directorate

PUBLICATIONS

Journal Articles

Kumawat, D., Ebtehaj, A., Xu, X., Colliander, A., & Kumar, V. (2025). An Autoencoder Architecture for L-band Passive Microwave Retrieval of Landscape Freeze-Thaw Cycle. *IEEE Transactions on Geoscience and Remote Sensing*.

Kim, Y., Kimball, J. S., Parazoo, N., Xu, X., Colliander, A., Reichle, R., ... & Li, X. (2024). Diagnosing spring onset across the North American Arctic-boreal region using complementary satellite environmental data records. *Journal of Geophysical Research: Biogeosciences*, *129*(8), e2023JG007977.

Tsang, L., Liao, T. H., Tan, S., Xu, X., Bai, X., & Gao, R. (2024). Fast Calculations of Vector Electromagnetics in 3D Periodic Structures Based on Multiple Scattering Theory and Broadband Green's Function. *Progress In Electromagnetics Research*, *179*, 19-36.

Xu, H., Tsang, L., Xu, X., Yueh, S., Margulis, S. A., & Shah, R. (2023). Bistatic Rough Surface Scattering at P-Band in Grand Mesa Based on Lidar Observations of Surface Roughness and Topography. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*.

Jeong, J., Tsang, L., Xu, X., Yueh, S., & Margulis, S. A. (2023). Full-wave electromagnetic model simulations of P-band radio signal propagation through forest using the fast hybrid method. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*.

Liao, T. H., Tsang, L., Tan, S., Xu, X., & Bai, X. (2023, July). Fast Calculations of Bands of Vector Electromagnetic Waves in 3D Periodic Structures Using Broadband Green's Function-Multiple Scattering Theory (BBGF-MST). In *2023 Photonics & Electromagnetics Research Symposium (PIERS)* (pp. 1673-1677). IEEE.

Zhu, J., Tsang, L., & Xu, X. (2023). Modeling of Scattering by Dense Random Media Consisting of Particle Clusters With DMRT Bicontinuous. *IEEE Transactions on Antennas and Propagation*.

Tsang, L., Durand, M., Derksen, C., Barros, A. P., Kang, D. H., Lievens, H., ... & Xu, X. (2022). Global monitoring of snow water equivalent using high-frequency radar remote sensing. The Cryosphere, 16(9), 3531-3573.

Lei, Y., Xu, X., Baldi, C. A., De Bleser, J. W., Yueh, S. H., Esteban-Fernandez, D., ... & Siqueira, P. (2022). Dry Snow Parameter Retrieval With Ground-Based Single-Pass Synthetic Aperture Radar Interferometry. IEEE Transactions on Geoscience and Remote Sensing, 60, 1-14.

Yi, Y., Chen, R. H., Kimball, J. S., Moghaddam, M., Xu, X., Euskirchen, E. S., ... & Miller, C. E. (2022). Potential Satellite Monitoring of Surface Organic Soil Properties in Arctic Tundra From SMAP. Water Resources Research, 58(4), e2021WR030957.

Yueh, S.H., Shah, R., Xu, X., Stiles, B. and Bosch-Lluis, X., 2021. A Satellite Synthetic Aperture Radar Concept Using P-Band Signals of Opportunity. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, *14*, pp.2796-2816.

Huang, H., Liao, T.H., Kim, S.B., Xu, X., Tsang, L., Jackson, T.J. and Yueh, S., 2021. L-Band Radar Scattering and Soil Moisture Retrieval of Wheat, Canola and Pasture Fields for SMAP Active Algorithms. *Progress In Electromagnetics Research*, *170*, pp.129-152.

Yueh, S.H., Shah, R., Chaubell, M.J., Hayashi, A., Xu, X. and Colliander, A., 2020. A Semiempirical Modeling of Soil Moisture, Vegetation, and Surface Roughness Impact on CYGNSS Reflectometry Data. *IEEE Transactions on Geoscience and Remote Sensing*.

Huang, H., Tsang, L., Colliander, A., Shah, R., Xu, X. and Yueh, S., 2020. Multiple Scattering of Waves by Complex Objects Using Hybrid Method of T-Matrix and Foldy-Lax Equations Using Vector Spherical Waves and Vector Spheroidal Waves. Progress In Electromagnetics Research, 168, pp.87-111.

Xu, X., R. S. Dunbar, C. Derksen, A. Colliander, Y. Kim, and J. S. Kimball. 2018. SMAP L3 Radiometer Global and Northern Hemisphere Daily 36 km EASE-Grid Freeze/Thaw State, Version 2. [Indicate subset used]. Boulder, Colorado USA. NASA National Snow and Ice Data Center Distributed Active Archive Center. doi: https://doi.org/10.5067/YN94K53QM061. [Date Accessed]

Kim, Y., Kimball, J.S., Xu, X., Dunbar, R.S., Colliander, A. and Derksen, C., 2019. Global Assessment of the SMAP Freeze/Thaw Data Record and Regional Applications for Detecting Spring Onset and Frost Events. *Remote Sensing*, *11*(11), p.1317.

Rowlandson, T. L.; Berg, A. A.; Roy, A.; Kim, E.; Pardo Lara, R.; Powers, J.; Lewis, K.; Houser, P.; McDonald, K.; Toose, P.; Wu, A.; De Marco, E.; Derksen, C.; Entin, J.; Colliander, A.; Xu, X.; Mavrovic, A., Capturing agricultural soil freeze/thaw state through remote sensing and ground observations: A soil freeze/thaw validation campaign. *Remote Sensing of Environment* **2018,** *211*, 59-70.

Derksen, C.; Xu, X.; Scott Dunbar, R.; Colliander, A.; Kim, Y.; Kimball, J. S.; Black, T. A.; Euskirchen, E.; Langlois, A.; Loranty, M. M.; Marsh, P.; Rautiainen, K.; Roy, A.; Royer, A.; Stephens, J., Retrieving landscape freeze/thaw state from Soil Moisture Active Passive (SMAP) radar and radiometer measurements. *Remote Sensing of Environment* **2017,** *194*, 48-62.

Shah, R.; Xu, X.; Yueh, S.; Chae, C. S.; Elder, K.; Starr, B.; Kim, Y., Remote Sensing of Snow Water Equivalent Using P-Band Coherent Reflection. *IEEE Geoscience and Remote Sensing Letters* **2017,** *14*, 309-313.

Yueh, S. H.; Xu, X.; Shah, R.; Kim, Y.; Garrison, J. L.; Komanduru, A.; Elder, K., Remote Sensing of Snow Water Equivalent Using Coherent Reflection From Satellite Signals of Opportunity: Theoretical Modeling. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing* **2017,** *10*, 5529-5540.

Chang, W.; Ding, K.; Tsang, L.; Xu, X., Microwave Scattering and Medium Characterization for Terrestrial Snow With QCA–Mie and Bicontinuous Models: Comparison Studies. *IEEE Transactions on Geoscience and Remote Sensing* **2016,** *54*, 3637-3648.

Huang, H.; Kim, S.; Tsang, L.; Xu, X.; Liao, T.; Jackson, T. J.; Yueh, S. H., Coherent Model of L-Band Radar Scattering by Soybean Plants: Model Development, Evaluation, and Retrieval. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing* **2016,** *9*, 272-284.

Tan, S.; Xiong, C.; Xu, X.; Tsang, L., Uniaxial Effective Permittivity of Anisotropic Bicontinuous Random Media Using NMM3D. *IEEE Geoscience and Remote Sensing Letters* **2016,** *13*, 1168-1172.

Xu, X.; Derksen, C.; Yueh, S. H.; Dunbar, R. S.; Colliander, A., Freeze/Thaw Detection and Validation Using Aquarius' L-Band Backscattering Data. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing* **2016,** *9*, 1370-1381.

Kim, S.; Jackson, T. J.; Yueh, S. H.; Xu, X.; Hensley, S., Feasibility of Inter-Comparing Airborne and Spaceborne Observations of Radar Backscattering Coefficients. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing* **2015,** *8*, 3507-3519.

Chang, W.; Tan, S.; Lemmetyinen, J.; Tsang, L.; Xu, X.; Yueh, S. H., Dense Media Radiative Transfer Applied to SnowScat and SnowSAR. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing* **2014,** *7*, 3811-3825.

Kim, S.; Moghaddam, M.; Tsang, L.; Burgin, M.; Xu, X.; Njoku, E. G., Models of L-Band Radar Backscattering Coefficients Over Global Terrain for Soil Moisture Retrieval. *IEEE Transactions on Geoscience and Remote Sensing* **2014,** *52*, 1381-1396.

Colliander, A.; Xu, X., Normalized Residual Scattering Index Applied to Aquarius L-Band Measurements. *IEEE Geoscience and Remote Sensing Letters* **2013,** *10*, 890-894.

Tsang, L.; Koh, I.; Liao, T.; Huang, S.; Xu, X.; Njoku, E. G.; Kerr, Y. H., Active and Passive Vegetated Surface Models With Rough Surface Boundary Conditions From NMM3D. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing* **2013,** *6*, 1698-1709.

Tsang, L.; Ding, K. H.; Huang, S.; Xu, X., Electromagnetic Computation in Scattering of Electromagnetic Waves by Random Rough Surface and Dense Media in Microwave Remote Sensing of Land Surfaces. *Proceedings of the IEEE* **2013,** *101*, 255-279.

Xu, X.; Tsang, L.; Yueh, S., Electromagnetic Models of Co/Cross Polarization of Bicontinuous/DMRT in Radar Remote Sensing of Terrestrial Snow at X- and Ku-band for CoReH2O and SCLP Applications. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing* **2012,** *5*, 1024-1032.

Ding, K. H.; Xu, X.; Tsang, L., Electromagnetic Scattering by Bicontinuous Random Microstructures With Discrete Permittivities. *IEEE Transactions on Geoscience and Remote Sensing* **2010,** *48*, 3139-3151.

Xu, X.; Liang, D.; Tsang, L.; Andreadis, K. M.; Josberger, E. G.; Lettenmaier, D. P.; Cline, D. W.; Yueh, S. H., Active Remote Sensing of Snow Using NMM3D/DMRT and Comparison With CLPX II Airborne Data. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing* **2010,** *3*, 689-697.

Liang, D.; Xu, X.; Tsang, L.; Andreadis, K. M.; Josberger, E. G., The Effects of Layers in Dry Snow on Its Passive Microwave Emissions Using Dense Media Radiative Transfer Theory Based on the Quasicrystalline Approximation (QCA/DMRT). *IEEE Transactions on Geoscience and Remote Sensing* **2008,** *46*, 3663-3671.

PROFESSIONAL ACTIVITIES

- Associate Editor, Remote Sensing, Special Issue "Advanced Microwave Remote Sensing Technologies for Hydrology", 2024
- Reviewed nearly a hundred journal papers as a peer reviewer for various academic journals and magazines (https://www.webofscience.com/wos/author/record/871520)
- Serve on review panel for various NASA Research Opportunities in Space and Earth Science Call, since 2021
- RSCL Champions, IEEE Remote Sensing Code Library, 2018
- Session Chair, IEEE International Geoscience and Remote Sensing Symposium since 2015
- Organizing Committee, Progress in Electromagnetics Research Symposium (PIERS) in St Petersburg, 2017

RESEARCH GRANTS

- Co-I (2024), NASA Earth Science U.S. Participating Investigator, “ROSE-L Soil Moisture Retrieval Using the SMAP and NISAR Algorithm”
- JPL-PI (2024), NASA Terrestrial Hydrology Proposal 24 “Development of a multi-frequency InSAR phase data assimilation framework for improved seasonal SWE characterization”
- PI (2020), NASA CYGNSS20 “Improve Soil Moisture Retrieval and Vegetation Optical Depth using CYGNSS v3 data”
- Co-I (2019), NASA Instrument Incubator Program, “Signals of Opportunity Synthetic Aperture Radar for High Resolution Remote Sensing of Land Surfaces”
- Co-I (2018), NASA Remote Sensing Theory, “Theoretical Basis for P-band Signals of Opportunity for remote sensing of Snow Water Equivalent”
- Co-I (2017), NASA CYGNSS17, “CYGNESS Soil Moisture Algorithm and Validation”
- Co-I (2017), NASA Terrestrial Hydrology Proposal, “P-Band Signals of Opportunity for Remote Sensing of Root Zone Soil Moisture and Snow”
- PI (2017), NASA Terrestrial Hydrology Proposal, “Multilayer forward model using SnowEX and TOMOSAR Datasets at X/Ku band, 2018-2020”

- Co-I (2016), NASA Terrestrial Hydrology Proposal, "Characterizing accuracy of an advanced snow water equivalent retrieval algorithm applied to airborne microwave remote sensing measurements"
- Collaborator (2015), NASA Science Utilization of the Soil Moisture Active-Passive Mission "Integrating Satellite Soil Moisture into Weather, Emission, and Air Quality Modeling"
- Co-I (2013), NASA ROSES Terrestrial Hydrology Proposal, "Radar Scattering from Terrestrial Snow at X band and Ku band: Forward Physical Models, Validation with SnowSAR data and Retrieval Algorithm"

TEACHING EXPERIENCE

University of Washington, *Seattle, WA, USA* Winter, 2011

Lecturer, Department of Electrical Engineering

- EE361 "Applied Electromagnetics"

TECHNICAL SKILLS

- Programming: Matlab, FORTRAN
- Measurement: Network Analyzer, Spectrum Analyzer