HALOVS Portfolio

Projects and Principal Investigators

LeviTAS

Institution Name: University of California, Los Angeles
PI and/or co-PI Name(s): Robert M'Closkey
Project Title: Electrostatic Levitation of Micro-Scale Systems

Institution Name: Northwestern University
PI and/or co-PI Name(s): Andrew Geraci, Selim Shahriar
Project Title: Optical levitation of mm-scale dielectric sensors

Institution Name: University of California, Irvine
PI and/or co-PI Name(s): Andrei Shkel, Camilo Velez Cuervo
Project Title: Untethered Micro-Hemispherical Resonance Gyroscope (u2-HRG)

Institution Name: Georgia Institute of Technology
PI and/or co-PI Name(s): Farrokh Ayazi, David Taylor
Project Title: Feedback-Controlled Levitation Optimization and Accurate Trapping of Sensors (FLOATS)

Institution Name: University of Florida, University of Central Florida
PI and/or co-PI Name(s): Philip Feng, Jaesung Lee
Project Title: Full Levitation in Magnetically Stabilized Systems (FLi-MaSS)

Institution Name: University of California, Los Angeles
PI and/or co-PI Name(s): Rob Candler, Martin Simon
Project Title: Split Pole Levitation with Integrated Capacitive Sensing (SPLICE)

Institution Name: University of California, Berkeley
PI and/or co-PI Name(s): Kristofer Pister
Project Title: Quad-mass levitated system

Institution Name: BAE Systems
PI and/or co-PI Name(s): Eric Langlois
Project Title: Magnetic And Acoustic Anti-Gravitation In Compact Size (MAAGICS)

NIMBUS

Institution Name: The Ohio State University, EngeniusMicro
PI and/or co-PI Name(s): Hanna Cho, Ata Donmez, Benoit Hamelin
Project Title: Stable, Nonlinear, and Internal-resonance-enhanced Transducers to Conquer velocity Hurdles (SNITCH)

Institution Name: University of Michigan, University of Florida
PI and/or co-PI Name(s): Roozbeh Tabrizian, Zetian Mi
Project Title: Single-crystal Power-insensitive dispeRsion-engIneered ResoNant acTuators (SPRINT)

Institution Name: Northeastern University
PI and/or co-PI Name(s): Cristian Cassella
Project Title: Enabling Higher Scale Factors in Gyroscopes through soFt and LocAlized Interface-States in MicroelectomecHanical resonators (FLASH)

Institution Name: Teledyne Scientific & Imaging, LLC; University of California, Los Angeles
PI and/or co-PI Name(s): Jeffrey DeNatale, Rob Candler, Robert M'Closkey
Project Title: non-Linear Ultra-fast Magnetically Operated micro-Systems (n-LUMOS)

Institution Name: University of California, Berkeley
PI and/or co-PI Name(s): Clark T.-C. Nguyen
Project Title: Displacement-Amplified High-Velocity Diamond Micromechanical Resonator

Institution Name: University of Texas at Austin, Stanford University
PI and/or co-PI Name(s): Ruochen Lu, Neal Hall, Juan Rivas-Davila
Project Title: Transducers for Optimized Robust Nonlinear Actuation and Dynamic Operation with Speed (TORNADO)

Institution Name: Yale University
PI and/or co-PI Name(s): Hong Tang
Project Title: High Dynamic Range Asymmetric Torsional Resonators (HiDART)

HORCREX

Institution Name: Georgia Institute of Technology
PI and/or co-PI Name(s): Azadeh Ansari, Farrokh Ayazi
Project Title: Parametrically-Excited Multi-modal Modelocked Mechanical Frequency Comb Inertial Sensor

Institution Name: Pennsylvania State University, EnginusMicro
PI and/or co-PI Name(s): Mingyo Park, Oliver Moreno
Project Title: Resilient Phononic Frequency Combs for Inertial Sensing

Institution Name: University of California, Irvine
PI and/or co-PI Name(s): Andrei M. Shkel
Project Title: Frequency Modulated double-ended Mechanical Integrator of Rotation Rejecting Accelerations (FM-deMIRA)

Institution Name: University of Texas at Austin
PI and/or co-PI Name(s): Ruochen Lu, Andrea Alu, Neal Hall
Project Title: Harmonic Oscillation Governing Wave Acoustic Resonance Transformation in Sensors (HOGWARTS)

CLOAK

Institution Name: University of California, Berkeley
PI and/or co-PI Name(s): Clark T.-C. Nguyen, Ali Javey
Project Title: Silicon Resonator Long-Term Stability Enhancement Via Localized Annealing

Institution Name: University of Central Florida
PI and/or co-PI Name(s): Piotr Kulik, Reza Abdolvand, Jaesung Lee
Project Title: Self-assembled-monolayer-Hafnium Interfaces for Enhanced Longevity and Durability (SHIELD)

Institution Name: University of Texas at Austin
PI and/or co-PI Name(s): Xiuling Li, Yuanyue Liu, Neal Hall
Project Title: Deuterium-Assisted MEMS Passivation and ALD- Enabled Response (DAMPER)

Institution Name: Purdue University, GE Aerospace, Forge Nano
PI and/or co-PI Name(s): Dana Weinstein, David Lin, Matthew Weimer
Project Title: Integrated Mechanical MicrO Resonators with Thin film ALD (IMMORTAL) MEMS

Institution Name: California Institute of Technology
PI and/or co-PI Name(s): Austin Minnich, Mohammad Mirhosseini
Project Title: Atomic layer etching to mitigate mechanical surface loss and drift in Si MEMS technology

Institution Name: HRL Laboratories, LLC
PI and/or co-PI Name(s): Ruwan Senaratne
Project Title: Reversible Electrochemical Alkali Getter for ENhanced microsystem sTability (REAGENT)

Institution Name: Draper
PI and/or co-PI Name(s): William Clower, Brian Dolle
Project Title: Silicon Ultralongevity Resonator Fatigue and Charge Evasion (SURFACE)

Pitch Day 2026

Institution Name: Massachusetts Institute of Technology
PI and/or co-PI Name(s): Luqiao Liu
Project Title: Giant Magnetoelectric Effect of Antiferromagnetic Semiconductors for Sensing, Computing and Information Storage

Institution Name: University of California, Berkeley
PI and/or co-PI Name(s): Asir Intisar Khan
Project Title: Altermagnetic Topological Semimetals for Field-free, Energy-Efficient Spin-Torque Memory

Associated Seedlings

Institution Name: Jet Propulsion Laboratory
PI and/or co-PI Name(s): Risaku Toda, Mina Rais-Zadeh, Yuki Maruyama
Project Title: Feedback-controlled Levitation Optimization and Accurate Trapping of Inertial Electrostatic Sensors (FLOATIES)

Institution Name: Cornell University, Massachusetts Institute of Technology
PI and/or co-PI Name(s): Gregory Fuchs, Paola Cappellaro
Project Title: Silicon Ultralongevity Resonator Fatigue and Charge Evasion (SURFACE)

Publications

LeviTAS

1. Y. Liu, D. Lovell, and K. S. J. Pister, "An SOI-PCB with Thermocompression Bonded CMOS, Multilayer Wiring, and Native MEMS," in Technical Digest of the Solid-State Sensors, Actuators and Microsystems Workshop (Hilton Head 2024), Hilton Head Island, SC, USA, 2024. doi.org/10.31438/trf.hh2024.110
2. Y. Liu, D. Lovell, T. Yuan, and K. S. J. Pister, "Toward a Self-Powered mm-Scale MEMS Sensor Platform through Heterogeneous Integration of SCUM and HV SOI CMOS," in Proceedings of the 23rd International Conference on Solid-State Sensors, Actuators and Microsystems (TRANSDUCERS 2025), Orlando, FL, USA, 2025. doi.org/10.1109/Transducers61432.2025.11110444
3. Y. Liu, D. Lovell, and K. S. J. Pister, "An Electrically Active SOI Out-of-plane Hinge for Multifunctional 3D Micro-mechanisms," in Technical Digest of the Solid-State Sensors, Actuators and Microsystems Workshop (Hilton Head 2026), Hilton Head Island, SC, USA, 2026.
4. V. Sharma, S. Askari, M. Simon, and R. Candler, "Electromagnet Levitator for Inertial Sensing," in Technical Digest of the Solid-State Sensors, Actuators and Microsystems Workshop (Hilton Head 2026), Hilton Head Island, SC, USA, June 2026.
5. S. S. Rashid, W. Yang, D. Etta, S. S. Yarajena, A. Lal, and K. K. Afridi, "A High-Performance Drive System for Piezoelectric Ultrasonic Transducers," in Proceedings of the IEEE Energy Conversion Congress and Exposition (ECCE), Vancouver, BC, Canada, Oct. 2026.
6. M. Shakibmanesh et al., "Dynamics, Stability, And Tunability of Diamagnetically Levitated Magnetic Platforms For Resonant Systems," in Technical Digest of the Solid-State Sensors, Actuators and Microsystems Workshop (Hilton Head 2026), Hilton Head Island, SC, USA, June 2026. doi.org/10.1109/Transducers61432.2025.11111184
7. L. Meira-Lopez, M. Shakibmanesh, C. Velez Cuervo, and A. M. Shkel, "Inertial Excitation And Optical Sensing For Diamagnetically Levitated Gyroscopes," in Technical Digest of the Solid-State Sensors, Actuators and Microsystems Workshop (Hilton Head 2026), Hilton Head Island, SC, USA, June 2026.

8. L. Meira-Lopez, A. R. Parrish, and A. M. Shkel, "Chemical etching based trimming process for Sub-Hz permanent frequency tuning of fused Quartz vibratory gyroscopes," in Technical Digest of the Solid-State Sensors, Actuators and Microsystems Workshop (Hilton Head 2026), Hilton Head Island, SC, USA, 2026.
9. M. Shakibmanesh et al., "Diamagnetic Levitation of Gyroscopes with Dynamic Control," in Proceedings of the 23rd International Conference on Solid-State Sensors, Actuators and Microsystems (Transducers 2025), Orlando, FL, USA, 2025, pp. 763–766.
10. L. Yi et al., "Low-Power Phononic Frequency Combs In Superconducting MEMS At 300 mK," in Technical Digest of the Solid-State Sensors, Actuators and Microsystems Workshop (Hilton Head 2026), Hilton Head Island, SC, USA, 2026.
11. S. Yasmin, P. Roy, Y. Wang, P. X.-L. Feng, and J. Lee, "LiNbO3 Microelectromechanical Resonators on Diamagnetically Levitated Graphite Platform," in Technical Digest of the Government Microcircuit Applications & Critical Technology Conference (GOMACTech 2026), New Orleans, LA, USA, March 9–12, 2026.
12. S. Yasmin, P. Roy, Y. Wang, P. X.-L. Feng, and J. Lee, "High-Q Diamagnetically Levitated Mechanical Resonators with Time-Domain Ring-Down Measurements," in Proceedings of the 23rd International Conference on Solid-State Sensors, Actuators and Microsystems (Transducers 2025), Orlando, FL, USA, June 29–July 3, 2025. doi.org/10.1109/Transducers61432.2025.11109605
13. Y. Wang, A. Gage, P. Roy, S. Yasmin, J. Lee, and P. X.-L. Feng, "Diamagnetically Levitated and Trapped Graphite Composite Mechanical Resonators," in Proceedings of the IEEE 38th International Conference on Micro Electro Mechanical Systems (MEMS 2025), Kaohsiung, Taiwan, January 19–23, 2025.
14. Roy, Pooja, Samira Yasmin, Yunong Wang, Philip X-L. Feng, and Jaesung Lee. "Highly stable diamagnetically levitated mechanical resonators with large masses exceeding 1.5 gram." Microsystems & Nanoengineering 12, no. 1 (2026): 79. doi.org/10.1038/s41378-025-01122-y
15. Y. Wang, A. Gage, P. Roy, S. Yasmin, J. Lee, P. X.-L. Feng, “Diamagnetically Levitated and Trapped Graphite Composite Mechanical Resonators”, in Tech. Digest, Government Microcircuit Applications & Critical Technology Conference (GOMACTech’25), Pasadena, SC, March 17-20 (2025).
16. Y. Wang, S. Yasmin, P. Roy, Ji Wang, J. Lee, P. X.-L. Feng, “High-Q Diamagnetically Levitated and Trapped Graphite Composite Mechanical Resonators”, IEEE Int. Frequency Control Symposium (IFCS’26), Tampa, FL, May 10-13 (2026)
17. P. Roy, S. Yasmin, Y. Wang, P. X.-L. Feng, J. Lee, “An Optoelectronic Feedback Oscillator Referenced to a Diamagnetically Levitated Mechanical Resonator”, IEEE Int. Frequency Control Symposium (IFCS’26), Tampa, FL, May 10-13 (2026).
18. S. Yasmin, P. Roy, Y. Wang, P. X.-L. Feng, J. Lee, “Ultralow-Loss Rotation and Internal-Resonance–Induced Frequency-Comb Generation in a Diamagnetically Levitated Graphite Rotor”, IEEE Int. Frequency Control Symposium (IFCS’26), Tampa, FL, May 10-13 (2026).

NIMBUS

1. Z. Liu et al., "High-velocity laser Doppler vibrometry measurements on an aluminum nitride bimorph wedge resonator," Communications Engineering, vol. 5, no. 1, Art. no. 48, 2026. doi.org/10.1038/s44172-026-00595-7
2. Z. Yao et al., "Single-crystal AlN wafer-based bulk acoustic resonators for piezoelectric power conversion," in Proceedings of the IEEE International Frequency Control Symposium (IFCS 2026), Tampa, FL, USA, May 10–13, 2026. arXiv:2603.19409
3. Z. Yao et al., "Radial mode lithium niobate Rosen transformer," in Proceedings of the IEEE 39th International Conference on Micro Electro Mechanical Systems (MEMS 2026), Salzburg, Austria, Jan. 25–29, 2026.
4. Z. Yao et al., "Periodically poled piezoelectric lithium niobate resonator for piezoelectric power conversion," Aug. 2025. arXiv:2508.09407
5. T.-H. Hsu et al., "Whip-mode flexural resonance in $LiTaO_3$-on-SiO_2 bimorph piezoelectric microresonator enabling near 60 m/s tip velocity," in Technical Digest of the Solid-State Sensors, Actuators and Microsystems Workshop (Hilton Head 2026), Hilton Head Island, SC, USA, June 2026.
6. T.-H. Hsu et al., "High-velocity whip-mode microresonator in LTOI bimorph: measurement methodology and large-signal characterization," submitted to IEEE Journal of Microelectromechanical Systems, 2026.
7. K. H. Zheng, W. Dong, H.-Y. Chen, and C. T.-C. Nguyen, "121-m/s diamond disk resonator," in Proceedings of the IEEE International Frequency Control Symposium (IFCS 2026), Tampa, FL, USA, May 10–13, 2026.

8. W. Dong, H.-Y. Chen, K. H. Zheng, X. Liu, and C. T.-C. Nguyen, "High velocity diamond disk resonator," in Proceedings of the IEEE International Conference on Micro Electro Mechanical Systems (MEMS 2026), Kaohsiung, Taiwan, Jan. 19–23, 2026, pp. 960–963. doi.org/10.1109/MEMS64181.2026.11419373
9. H.-Y. Chen, K. H. Zheng, X. Liu, W. Dong, and C. T.-C. Nguyen, "Passive self-temperature compensating diamond ring resonator," in Proceedings of the IEEE International Conference on Micro Electro Mechanical Systems (MEMS 2026), Kaohsiung, Taiwan, Jan. 19–23, 2026, pp. 1379–1382. doi.org/10.1109/MEMS64181.2026.11419625
10. X. Liu, K. H. Zheng, H.-Y. Chen, M. Akgul, and C. T.-C. Nguyen, "Temperature-compensated self-sensing diamond ring resonator," in Proceedings of the 23rd International Conference on Solid-State Sensors, Actuators and Microsystems (Transducers 2025), Orlando, FL, USA, June 29–July 3, 2025, pp. 92–95. doi.org/10.1109/Transducers61432.2025.11109881
11. O. Kaya et al., "Revolutionize Bulk Acoustic Wave Gyroscopes through the Exploitation of Topological Interface States," in Proceedings of the IEEE International Ultrasonics Symposium (IUS 2025), 2025, pp. 1–3. doi.org/10.1109/IUS62464.2025.11201319
12. T. Maggioli et al., "Topologically enhanced guided acoustic wave sensors," Physical Review Applied, vol. 24, no. 5, Art. no. 054007, 2025. doi.org/10.1103/l4y3-14dx
13. A. Marella et al., "Automated Reconstruction of Dispersion Relations and Bandgap Optimization in Topological Devices," in Proceedings of the IEEE MTT-S International Conference on Microwave Acoustics & Mechanics, April 20–22, 2026.
14. O. Kaya et al., "Toward Enhanced Inertial Sensing via Dynamically Soft Topological States in Piezoelectric Microacoustic Metamaterials," 2025. arXiv:2512.04382
15. O. Kaya et al., "Displacement Amplification Via Topologically Protected Interface States," in Technical Digest of the Solid-State Sensors, Actuators and Microsystems Workshop (Hilton Head 2026), Hilton Head Island, SC, USA, June 2026.
16. H. Herath et al., "Broad Nonlinear Dynamic Range Enabled By High Velocity T-Shaped MEMS Resonators," in Technical Digest of the Solid-State Sensors, Actuators and Microsystems Workshop (Hilton Head 2026), Hilton Head Island, SC, USA, June 2026.
17. S. Mishra, J. Gao, M. Hasan, and R. Tabrizian, "Self-Temperature-Stabilized AlScN-On-Si Resonator Enabled By 2:1 Internal Resonance," in Technical Digest of the Solid-State Sensors, Actuators and Microsystems Workshop (Hilton Head 2026), Hilton Head Island, SC, USA, June 2026.
18. J. Gao, S. Mishra, and R. Tabrizian, "Single-Pump Phase-Coherent Phononic Comb Chaining Across Two Octaves In CMOS-Compatible 15 Nm HZO Nanoresonators," in Technical Digest of the Solid-State Sensors, Actuators and Microsystems Workshop (Hilton Head 2026), Hilton Head Island, SC, USA, June 2026.

HORCREX

1. E. Wolgamot, L. Meira-Lopez, P. Carter, and A. M. Shkel, "First Observation of Phononic Frequency Combs in Dual-Shell Gyroscopes: A Path to Quasi-Digital FM Angular Sensing," in Proceedings of the IEEE International Symposium on Inertial Sensors and Systems (INERTIAL 2026), Destin, FL, USA, May 10–13, 2026.
2. I. Anderson et al., "Phononic combs in lithium niobate acoustic resonators," Applied Physics Letters, vol. 128, no. 5, Art. no. 052201, 2026. doi.org/10.1063/5.0304587
3. I. Anderson et al., "Enabling lithium niobate phononic frequency combs via thermal engineering and design," in Technical Digest of the Solid-State Sensors, Actuators and Microsystems Workshop (Hilton Head 2026), Hilton Head Island, SC, USA, June 2026.
4. Z. Yao et al., "Bimorph lithium niobate thickness-shear overtone resonator with high Q above 20,000 at 779 MHz," in Technical Digest of the Solid-State Sensors, Actuators and Microsystems Workshop (Hilton Head 2026), Hilton Head Island, SC, USA, June 2026.
5. M. Park, M. Kayyalha, J.-P. Maria, and S. Trolier-McKinstry, "Phononic Frequency Comb Generation via Nonlinear Modal Interactions in Piezoelectric MEMS," in Proceedings of the IEEE International Frequency Control Symposium (IFCS 2026), Tampa, FL, USA, May 10–13, 2026.
6. L. Yi et al., "Mechanical Frequency Comb Generation via Difference-Frequency Generation in a MEMS Resonator," in Proceedings of the IEEE International Frequency Control Symposium (IFCS 2026), Tampa, FL, USA, May 10–13, 2026.

7. Y. Zheng, S. M. H. Gangaraj, M. Park, J. Wang, and A. Ansari, "Phononic frequency combs with tunable frequency spacing for ultrasensitive temperature-sensing applications," Physical Review Applied, vol. 25, no. 2, Art. no. 024022, 2026. doi.org/10.1103/nn4s-1yrc

CLOAK

1. M. Franz et al., "Atomic Layer Deposition of HfO_2 for Quality Factor Enhancement in AlN MEMS Resonators," in Technical Digest of the Government Microcircuit Applications & Critical Technology Conference (GOMACTech 2026), New Orleans, LA, USA, March 9–12, 2026.
2. B. Kim et al., "Residual stress anisotropy in thin-film lithium niobate for stress-managed MEMS," in Proceedings of the IEEE 39th International Conference on Micro Electro Mechanical Systems (MEMS 2026), Salzburg, Austria, Jan. 25–29, 2026.
3. B. Kim, I. Anderson, T.-H. Hsu, and R. Lu, "Gradient residual stress in transferred thin-film lithium niobate and its compensation using periodically poled piezoelectric bilayers," Apr. 2026. arXiv:2604.20694
4. K. M. Nguyen et al., "Polarization retention studies as a function of depth for ferroelectric AlScN films grown by MOCVD," presented at The 68th Electronic Materials Conference (EMC 2026), June 24–26, 2026.
5. X. Liu et al., "Silicon carbide coating of MEMS resonators via localized annealing of amorphous carbon," in Proceedings of the IEEE International Frequency Control Symposium (IFCS 2026), Tampa, FL, USA, May 10–13, 2026.