Topic Number	Topic Name	Project Name	Sponsoring Office	Primary University Subaward Universities	University Location (state)	Principal Investigator
FY2020 MULTIDISCIPLINARY UNIVERSITY RESEARCH INITIATIVE (MURI) - SELECTED PROJECTS					
1	Stimuli-Responsive Materials based on Triggered Polymer Depolymerization	Informatics-Driven Design of Resilient and Deploymerizable Polymers	ONR	**Georgia Tech**	GA	Ramamurthy Ramprasad
2	Quantum Benefits without Quantum Fragility: The Classical Entanglement of Light	Classical Entanglement in Structured Optical Fields	ONR	**University of Central Florida** University of Southern California Cornell University Brown University	FL CA NY RI	Ayman Abouraddy
3	Mathematical Methods for Deep Learning	Theoretical Foundations of Deep Learning	ONR	**Rice University** University of Maryland Texas A&M Carnegie Mellon University University of Wisconsin-Madison University of California, Los Angeles	TX MD TX PA WI CA	Richard Baraniuk
4	Spin and Orbital Angular Momentum (SAM & OAM)	High Photon Density Spatiotemporal (OAM+SAM) Vector Beams for Maritime Environments	ONR	**Clemson University** Duke University University of Southern California University of Rochester University of Central Florida University of North Carolina - Charlotte	SC NC CA NY FL NC	Eric Johnson
5	Photonic High Order Topological Insulators (PHOTIs)	Robust Photonic Materials with High-Order Topological Protection	ONR	**University of Illinois** Pennsylvania State University University of Maryland Massachusetts Institute of Technology University of Pennsylvania	IL PA MD MA PA	Gaurav Bahl
6	Active Topological Mechanical Metamaterials	Active and Reconfigurable Topological Mechanical Metamaterials from the Nanoscale to the Macroscale	ONR	**University of Michigan** University of Illinois at Urbana-Champaign Dartmouth College	MI IL NH	Xiaoming Mao
7	Harvesting Oxygen from the Ocean	Next-Generation Materials for Oxygen Generation, Transport, and Storage in the Undersea Environment	ONR	**Harvard University** Massachusetts Institute of Technology Cornell University North Carolina State University	MA MA NY NC	Daniel Nocera

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colspan spanning	FY2020 MULTIDISCIPLINARY UNIVERSITY RESEARCH INITIATIVE (MURI) - SELECTED PROJECTS					
8	Exploring Oxidation and Surface Phenomena of Multi-Principal Element Alloys	From Percolation to Passivation (P2P): Multiscale Prediction and Interrogation of Surface and Oxidation Phenomena in Multi-Principle Element Alloys	ONR	**Johns Hopkins University** University of Virginia Northwestern University Arizona State University	MD VA IL AZ	Mitra Taheri
9	The Physics of High-Speed Multiphase-flow / Material Interactions	Particulate and Precipitation Effects on High-speed Flight Vehicles	ONR	**University of Minnesota** University of Maryland College Park Stevens Institute of Technology University of Hawaii	MN MD NJ HI	Thomas Schwartzentruber
10	Combining Disparate Environmental Data Into a Common Framework	Integrated Foundations of Sensing, Modeling, and Data Assimilation for Sea Ice Prediction	ONR	**Dartmouth College** Massachusetts Institute of Technology Arizona State University	NH MA AZ	Anne Gelb
11	Adaptive and Adversarial Machine Learning	Robust Concept Learning and Lifelong Adaptation against Adversarial Attacks	ARO	**University of Pennsylvania** Children's Hospital of Philadelphia	PA PA	Insup Lee
12	Axion Electrodynamics beyond Maxwell's Equations	Implementation of axion electrodynamics in topological films and devices	ARO	**Johns Hopkins University** University of Illinois at Urbana-Champaign North Carolina State University Rutgers, The State University of New Jersey University of California, Santa Barbara University of California, Los Angeles University of Pennsylvania	MD IL NC NJ CA CA PA	Norman Peter Armitage
13	Engineering Endosymbionts to Produce Novel Functional Materials	Endosymbiont Control and Enhancement of Leafhopper Brochosomes	ARO	**University of Texas at Austin** Northwestern University University of Illinois at Urbana-Champaign	TX IL IL	Jeffrey Barrick
14	Information Exchange Network Dynamics	A Multimodal Approach to Network Information Dynamics	ARO	**University of Illinois** Stanford University	IL CA	Cedric Langbort
15	Mathematical Intelligence: Machines with More Fundamental Capabilities	Toward Mathematical Intelligence and Certifiable Automated Reasoning: From Theoretical Foundations to Experimental Realization	ARO	**Harvard University** Johns Hopkins University University of California, Santa Barbara	MA MD CA	Arthur Jaffe

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16	Quantum State Engineering for Enhanced Metrology	Robust Entanglement-Enhanced Metrology with Atoms and Solid-State Spins	ARO	**Stanford University** California Institute of Technology University of California, Santa Barbara University of Chicago University of California, Berkeley	CA CA CA IL CA	Monika Schleier-Smith
17	Solution Electrochemistry without Electrodes	Plasma Driven Solution Electrochemistry	ARO	**University of Minnesota - Minneapolis** University of Michigan Northwestern University	MN MI IL	Peter Bruggeman
18	Stimuli-Responsive Mechanical Metamaterials	Triggering Outstanding Properties via Mechanical Adaptive Topologies (TOPMAT): Towards Dynamically Self-Amplifying Omniphoric Multiscale Metamaterials	ARO	**University of California, San Diego** University of Wisconsin - Madison Duke University University of Chicago University of Michigan	CA WI NC IL MI	Nicholas Boechler
19	Machine Learning and Physics-Based Modeling and Simulation	Learning and Meta-Learning of Partial Differential Equations via Physics-Informed Neural Networks: Theory, Algorithms, and Applications	AFOSR	**Brown University** Stanford University California Institute of Technology University of Utah	RI CA CA UT	George Em Karniadakis
20	Fundamental Design Principles for Engineering Orthogonal Liquid-Liquid Phase Separations in Living Cells	Uncovering and applying the interfacial design principles of multiphasic natural and synthetic organelles	AFOSR	**Princeton University** Duke University University of North Carolina - Chapel Hill Washington University in St. Louis	NJ NC NC MO	Clifford Brangwynne
21	Modeling, Prediction, and Mitigation of Rare and Extreme Events in Complex Physical Systems	ANSRE: ANalysis and Synthesis of Rare Events	AFOSR	**Stanford University** University of Maryland, College Park Massachusetts Institute of Technology Harvard University Duke University	CA MD MA MA NC	Jose Blanchet
22	Fundamental Limits of Controllable Waveform Diversity at High Power	Exploration of Fundamental Limits to High Power Electromagnetic Amplification	AFOSR	**University of New Mexico** University of Michigan University of California, Irvine Michigan State University University of Maryland	NM MI CA MI MD	Edl Schamiloglu

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23	Full Quantum State Control at Single Molecule Levels	New approaches to quantum control with individual molecule sensitivity	AFOSR	**Harvard University** Purdue University University of Colorado, Boulder University of California, Los Angeles University of California, Santa Barbara University of Maryland, College Park	MA IN CO CA CA MD	Kang-Kuen Ni
24	Constructive Mathematics and Its Synthetic Concepts from Type Theory	Synthetic and Constructive Mathematics of Higher Structures in Homotopy Type Theory	AFOSR	**University of San Diego** Carnegie Mellon University Johns Hopkins University University of Minnesota Wesleyan University	CA PA MD MN CT	Michael Shulman
25	Weyl Fermion Optoelectronics	Novel Light-Matter Interactions in Topologically Non-Trivial Weyl Semimetal Structures and Systems	AFOSR	**University of Southern California** University of Central Florida Purdue University Northeastern University University of Tennessee	CA FL IN MA TN	Mercedeh Khajavikhan
26	Mechanisms of Ice Nucleation and Anti-Icing Constructs	Unraveling the Mechanisms of Ice Nucleation and Anti-Icing Through an Integrated Multiscale Approach	AFOSR	**University of California, San Diego** University of Utah University of Illinois at Urbana-Champaign Tufts University University of California, Santa Barbara Cornell University University of Chicago	CA UT IL MA CA NY IL	Francesco Paesani