Fiscal Year:	FY 2019	**Task Last Updated:**	FY 04/14/2019
PI Name:	Hyers, Robert Ph.D.		
Project Title:	Thermophysical Properties and Transport Phenomena Models and Experiments in Reduced Gravity		
Division Name:	Physical Sciences		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:	MATERIALS SCIENCE--Materials science		
Joint Agency Name:		**TechPort:**	No
Human Research Program Elements:	None		
Human Research Program Risks:	None		
Space Biology Element:	None		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	None		
PI Email:	hyers@ecs.umass.edu	**Fax:**	FY
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City:	Amherst	**State:**	MA
Zip Code:	01003	**Congressional District:**	2
Comments:			
Project Type:	FLIGHT	**Solicitation:**	2015 NNH15ZTT002N MaterialsLab Open Science Campaigns for Experiments on the International Space Station
Start Date:	06/06/2017	**End Date:**	06/05/2022
No. of Post Docs:	0	**No. of PhD Degrees:**	0
No. of PhD Candidates:	0	**No. of Master' Degrees:**	0
No. of Master's Candidates:	0	**No. of Bachelor's Degrees:**	0
No. of Bachelor's Candidates:	0	**Monitoring Center:**	NASA MSFC
Contact Monitor:	Rogers, Jan	**Contact Phone:**	256.544.1081
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Flight Program:			
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Lee, Jonghyun Ph.D. (Iowa State University (formerly University of Massachusetts))		
Grant/Contract No.:	NNX17AL63G		
Performance Goal No.:			
Performance Goal Text:			

Task Description:	The proposed program will consist of four major elements: continued development of novel non-contact methods for measuring thermophysical properties, including using electrostatic levitation in reduced gravity; application of these methods to materials of interest to industry and the international scientific community; application of the measured properties to produce accurate models of fluid flow and heat and mass transfer in the levitated samples; and application of the measured properties and models to test theories about the effect of processing on microstructure and material characteristics of a family of nonlinear optical crystals. The proposed elements primarily contribute to the research emphasis 1: Thermophysical Property Measurements, with supporting contributions to research emphasis; 2: Materials Processes Affecting Microstructure, Composition, and the Resultant Material Characteristics. The proposed elements vary in scope from the development of methods which are broadly applicable to measurement of thermophysical properties such as density and viscosity, to measurement of the properties of samples proposed by our team and other investigators in MaterialsLab, so models for specific experiments. Through the insight into the transport phenomena inside the samples, the experiment-specific models enable experiments that would otherwise be impossible. Similar models are currently in use for model-enabled experiments on the International Space Station. The results of the model-enabled experiments will advance the scientific understanding of the effect of processing on the properties of non-linear optical crystals, moving them closer to commercial production and sale here on Earth.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	This project has the potential to improve the manufacturability of photonic devices based on photorefractive materials. Among the many applications are holographic storage of data. The ability to switch light with light could also have a large impact on telecommunications.
Task Progress:	The Principal Investigator (PI) visited Marshall Space Flight Center (MSFC) in August 2018 with one grad student. We worked with MSFC staff to explore one method of fabricating samples for this investigation. We concluded that other methods should be explored for achieving the tight composition window needed for the proposed work. After phasing discussions with MSFC, we agreed to push the work for FY'19 to the summer and fall, to allow continuity of funding for one or more students to prepare the bulk of the ground-based work in FY'20. The funding profiles were adjusted accordingly. We are targeting SCR (science concept review) in FY'21 and flight in '22. A new graduate student visited UMass in March 2019, and will join us in June 2019. She will work on this project part-time.
Bibliography Type:	Description: (Last Updated: 04/28/2020)
Abstracts for Journals and Proceedings	SanSoucie MP, Hyers RW, Rogers JR. "Electrostatic Levitation for Studies of Additive Manufacturing Materials for Extreme Environments." Poster presented at Materials Science and Technology Conference MS&T18, Columbus, OH, October 14-18, 2018. Conference Program. Materials Science and Technology Conference MS&T18, Columbus, OH, October 14-18, 2018. , Oct-2018