Fiscal Year:	FY 2014	**Task Last Updated:**	FY 07/25/2014
PI Name:	Sackett, Cass Ph.D.		
Project Title:	Development of Atom Interferometry Experiments for the International Space Station's Cold Atom Laboratory		
Division Name:	Physical Sciences		
Program/Discipline:			
Program/Discipline--Element/Subdiscipline:	FUNDAMENTAL PHYSICS--Fundamental physics		
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		
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City:	Charlottesville	**State:**	VA
Zip Code:	22904-1000	**Congressional District:**	5
Comments:			
Project Type:	FLIGHT,GROUND	**Solicitation / Funding Source:**	2013 Fundamental Physics NNH13ZTT002N (Cold Atom Laboratory--CAL)
Start Date:	04/01/2014	**End Date:**	10/30/2017
No. of Post Docs:		**No. of PhD Degrees:**	
No. of PhD Candidates:		**No. of Master' Degrees:**	
No. of Master's Candidates:		**No. of Bachelor's Degrees:**	
No. of Bachelor's Candidates:		**Monitoring Center:**	NASA JPL
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Flight Program:	ISS		
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Burke, John Ph.D. (Air Force Research Laboratory)		
Grant/Contract No.:	JPL 1502012		
Performance Goal No.:			
Performance Goal Text:			

The ultimate objective of this proposal is to develop an ultra-high sensitivity atom interferometer capable of operating in and benefiting from a microgravity environment. The interferometer would be specifically suited for measurements of rotations, but it would be broadly applicable to a variety of precision measurements.
The interferometer will use a low-density Bose-Einstein condensate, as this form of matter has the lowest possible velocity spread and thus allows for the longest possible measurement times. Many of the required components have already been demonstrated in our terrestrial experiments, including long-duration interferometry, high fidelity control of atomic motion using optical pulses, expansion of condensates to extremely low density, and rotation-sensitive interferometer geometries. We will combine these components and investigate their optimization for microgravity performance.

Task Description:	We have also demonstrated an optical levitation technique that permits the table-top simulation of microgravity, up to times of about one second. We will use this approach to test the interferometer performance in a terrestrial experiment without the expense and complexity of a drop tower apparatus. The work will be carried in collaboration between the University of Virginia and the AFRL Space Vehicles Directorate at Kirtland Air Force Base. This work is highly relevant to the objectives of the solicitation, which specifically calls for the development of atom interferometer experiments. The precise measurement of rotations is of immediate utility for space-based navigation systems and testing of general relativistic predictions. However, the techniques developed would be readily applicable to other interferometric measurements, such as acceleration. The program solicitation indicates that atom interferometry experiments would be projected for future upgrades to the CAL facility. Besides ground based preparatory work, we propose a preliminary flight experiment to investigate the adiabatic release of a trapped condensate. This will test the critical ability to attain samples with very low relative and mean velocities. It also would likely produce the lowest-temperature matter yet attained. This experiment would be important for future interferometry development, and also other potential experiments that require ultra-low atomic velocity.
Rationale for HRP Directed Research:	
Research Impact/Earth Benefits:	
Task Progress:	New project for FY2014.
Bibliography Type:	Description: (Last Updated: 02/15/2024)