National Aeronautics and Space Administration

NATIONAL SPACE GRANT COLLEGE AND FELLOWSHIP PROGRAM

STEM INSPIRE - ENGAGE - EDUCATE - EMPLOY

The Next Generation of Explorers

Mid-Atlantic Space Grant Consortia Meeting

September 12th- 14th, 2019

Charleston, WV

NASA Goddard Space Flight Center

Research Collaboration Opportunities

James Harrington

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About Me

- Educational Background: BS Computer Science
- Years at NASA: 25
- Past work experiences at NASA:
  - Started in High Performance Networking Branch
  - 1995 Project Manager of $2.5M Minority University-Space Interdisciplinary Network Project connecting over 80 Minority Serving Institutions to high performance networking and science collaborations.
- 2012 Learning Technologies Project Manager producing Massively Multiplayer Online Game (MMOG) “Moonbase Alpha”. 3rd most popular free game on the STEAM Server
- 2016 Principal Investigator for Office of STEM Engagement “NASA Network of States Professional Development in partnership with NASA MD’s and CoSTEM (Federal Agency Coordination for STEM)” Award.

Center Engagement Portfolio

- Space Grant
  - Specialist – James Harrington
- EPSCoR
  - Specialist – James Harrington

- MUREP – TBD

- NextGEN STEM
  - Specialist – Denise Davis

- NASA Internship and Fellowships (NIFS)
  - Specialist – Raquel Marshall

- STEM Capacity Building Infrastructure for SMD Science Activation
  - Partnership leads – Bob Gabrys, James Harrington

Opportunities for Students and Faculty

Topic: Internships and Fellowships

As of May 30, 2019, we have 434 interns placed for the Summer 2019

- Summer Internship session dates per campus

	College Interns	High School Interns
GSFC	6/3/19 – 8/9/19	6/24/19 – 8/2/19
WFF	6/3/19 – 8/9/19	6/24/19 – 8/2/19
IVV	5/28/19 – 8/2/19	6/11/19 – 7/19/19
GISS	Multiple start dates	7/2/19 – 8/9/19

Location	# of Interns
Goddard Institute for Space Studies (GISS)	20*
Goddard Space Flight Center	355
Independent Verification and Validation Facility (IVV)	26
Wallops Flight Facility	33
Grand Total	**434**

47 Interns funded by Space Grant Consortiums

Opportunities for Students and Faculty con't

Fellowship

We have four NASA fellows completing their summer internships at Goddard this summer.

Fellow Name	NASA Mentor	Code
Ariel Deutsch	Gregory A. Neumann	698
Alexander Johnson	Manohar Deshpande	555
Rebecca Phillipson	Patricia Boyd	667
Elizabeth Klovenski	Susanne Bauer/ Konstantinos Tsigaridis	611 (GISS)

Opportunities for Students and Faculty Con't

o NASA's new Moon to Mars initiative where potential collaboration opportunities with GSFC will be later defined - The campaign has four strategic goals: Transition U.S. human spaceflight in low-Earth orbit to commercial operations... Extend long-duration U.S. human spaceflight operations to lunar orbit. Enable long-term robotic exploration of the Moon. Enable human exploration of the Moon as preparation

O Latest in Earth Science Remote Sensing and Climate Change Visualizations

o WFIRST Telescope being built here at GSFC - The Wide Field Infrared Survey Telescope (WFIRST) is a NASA infrared space observatory currently under development. WFIRST was recommended in 2010 by United States National Research Council Decadal Survey committee as the top priority for the next decade of astronomy. On February 17, 2016, WFIRST was approved for development and launch.

o Data Science/Machine Learning/Artificial Intelligence - NASA plans to establish a permanent presence on the Moon. Getting there will involve the use of robots and instruments that think like humans. Goddard researchers are working to make this happen.

Artificial Intelligence and Machine Learning

- Goddard Space Flight Center's Computation and Information Systems Technology Office (CISTO and Science Mission Directorate (SMD) announce collaborative research opportunities in areas of a) Artificial Intelligence and Machine Learning (AI/ML), b) High Performance Computing, c) Augmented Reality/Virtual Reality/Mixed Reality (AR/VR/MR), and d) Citizen Science to enable and accelerate scientific discovery and technological innovations for NASA's scientific missions. NASA's scientific lines of business include Earth Sciences, Planetary Sciences, Astrophysics, and Heliophysics.

- Recent advances in AI infrastructure and tools calls for development of AI algorithms for various, yet unexplored, scientific data *classification, search, prediction, feature selection, and modeling* problems in different NASA scientific areas. Some past work includes classification of supernova to better measure cosmic distances and understand expansion of universe, classification of Planets to better predict probability of life, finding craters on moon, search for gravitational waves, and search for exoplanets. Similar techniques can be applied for finding different phenomena (e.g. feature detection for identifying safe landing sites, finding faint moving objects, etc.), environmental feature recognition (forest patches, water bodies, agriculture fields, etc.), or to other fields such as Earth Science and Heliophysics data. Another topic of interest is to apply AI/ML techniques to NASA data in time domain, or time-series analysis (e.g. when studying solar winds or various Earth observations).

High Performance Computing: Evolving Applications to Exascale

- High Performance Computing (HPC) applications across NASA have seen a significant increase in computational capability over the past decade using cluster systems with traditional CPU-only based capabilities. The architectures being deployed across the US and abroad to reach the next milestone of computing, Exascale, have a significantly different architecture based on accelerated computing using Graphical Processing Units (GPUs). NASA applications, such as atmospheric models, will require Exascale computational capabilities over the next decade. Research investigations addressing the porting and scaling of HPC applications on accelerated based HPC are encouraged. Furthermore, the use of Domain Specific Languages (DSLs), such as Kokkos or GridTools, to create portable and optimized applications for different architectures is of high interest.

Augmented Reality/Virtual Reality/Mixed Reality

- AR/VR applications allow scientists to experience being in environments that are hard, impossible, or too costly in person. For example, existing NASA AR/VR applications enable immersive exploration of places deep in the ocean, to distant planetary surfaces and galaxies or to experiment with various robotic or spacecraft assembly and integration processes in AR/VR before taking high risks on the actual expensive hardware.

Citizen Science

- Various NASA projects have used Internet tools and technologies not only as a public outreach and education tool but as a means to engage ordinary citizens in their projects and most importantly to contribute to their scientific discoveries. Examples of such NASA citizen science projects are GLOBE Observer (https://observer.globe.gov), Planet Hunters (www.planethunters.org), Backyard Worlds: Planet 9 (www.backyardworlds.org), Moon Zoo (www.moonzoo.org) and Galaxy Zoo (www.galaxyzoo.org).

References

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- Nargess Memarsadeghi, ``Citizen Science", *Computing in Science and Engineering*, Vol.17, No. 4, pp. 8-10, July-Aug. 2015, doi link.
- https://www.fedscoop.com/nasa-virtual-reality/
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- "Augmented Reality/Virtual Reality for Goddard's Science and Engineering",
- "NASA Taps Young People to Help Develop Virtual Reality Technology"
- Thomas G Grubb, William Brent Garry, Matthew A Brandt, Troy Ames, Douglas C Morton, David Lagomasino, Stephanie Schollaert Uz, and Nargess Memarsadeghi *"Science Data Visualization in AR/VR for Planetary and Earth Science"*, 2018 AGU Fall Meeting
- http://www.astronomy.com/news/2017/01/astronomers-use-artificial-brains
- https://www.space.com/40203-artificial-intelligence-classify-planets-probability-life.html
- https://www.theverge.com/2018/3/29/17175580/ai-astronomy-moon-6000-craters
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Cross Cutting Technology and Capabilities (CCTC)

- Goddard's level of excellence will be informed by our ability to be an innovation-driven organization that collaboratively envisions, enables, and delivers compelling spacecraft missions, systems, and capabilities relevant to strategic interests. Sustained excellence requires the center demonstrates proficiency with technologies and capabilities-heritage and emerging-relevant to future strategic mission concepts and engineering challenges.

CCTC Advancement Program

- Instrument and Space Systems Intelligence and Autonomy
  - Intelligent Instruments and Sensors: There have been marked advancements in the ability to host Artificial Intelligence (AI) capabilities on spaceflight platforms. This thrust targets a convergences of AI, instrument/sensor/detector technology, and systems integration approaches to disrupt heritage perspectives.
    - What approaches enable transformational mission and measurement capabilities by migrating intelligence from the ground to the in-situ environment in a manner that “short circuits” data volume, communications bandwidth challenges, and latencies that result from ground-based decision making?
    - What approaches can open the “black box” nature of AI and the resultant hesitancy to infuse it into many spaceflight environments by demonstrating levels of trust consistent with targeted levels of mission confidence? (trusted autonomy)
    - How can work such as that described in the article “IBM helped Fix One of its Satellites Using Cutting-Edge Deep Learning AI” impact GSFC considering instrument/measurement capabilities?
    - How do we leverage capabilities such as those described in the article “Delivering Artificial Intelligence to Space?”

Leveraging the External Landscape

- The Center must demonstrate an awareness of competencies and capabilities resident at other NASA center, or other government agencies, industry, and academia, and leverage them to the extent practical.

Contact Information

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Questions