AO# 7599

Project Title: Visual perception technologies for multi-mission, multi-agent maritime robotics

Background Information: JPL leads a variety of maritime robotics research projects. We are designing systems for (a) coordinated behaviors for teams of robotic agents, and (b) vision-based situational awareness that aid in guiding that team. The application that will be addressed will be for autonomous unmanned surface vehicles (robotic boats).

Project Description: The student will assist in development and testing algorithms for stereo and monocular vision-based perception systems. This may include prototyping computer vision algorithms, improving tooling, improving existing computer vision software, managing datasets, and managing experiments to evaluate the performance of existing algorithms. The student will contribute to a JPL team of autonomy and computer vision experts.

Suggested and/or Required Background & Skills: Strong software engineering skills, experience with modern C++, experience with C, comfortable in a Unix/Linux development environment, experience in computer vision (stereo or monocular) tasks such as object detection and recognition. No previous experience or specific software skills required for roles in managing and annotating data sets and running experiments.

Web or Literature References: M. T. Wolf, C. Assad, Y. Kuwata, A. Howard, H. Aghazarian, D. Zhu, T. Lu, A. Trebi-Ollennu, and T. Huntsberger, â€œ360-degree visual detection and target tracking on an autonomous surface vehicleâ€, Journal of Field Robotics, vol. 27, Nov. 2010 T. Huntsberger, H. Aghazarian, A. Howard, and D. Trotz, â€œStereo visionâ€“based navigation for autonomous surface vesselsâ€, Journal of Field Robotics, vol. 28, Jan. 2011. Y. Kuwata, M. T. Wolf, D. Zarzhitsky, and T. L. Huntsberger, "Safe Maritime Autonomous Navigation with COLREGS, Using Velocity Obstacles," IEEE Journal of Oceanic Engineering, 39(1): 110-119, 2014. T. Huntsberger, P. Pirjanian, A. Trebi-Ollennu, H.D. Nayar, H. Aghazarian, A. Ganino, M. Garrett, S.S. Joshi, and P.S. Schenker, "CAMPOUT: A Control Architecture for Tightly Coupled Coordination of Multi-Robot Systems for Planetary Surface Exploration," IEEE Trans. Systems, Man & Cybernetics, Part A: Systems and Humans, Special Issue on Collective Intelligence, 33(5): 550-559, 2003. A. Stroupe, A. Okon, M. Robinson, T. Huntsberger, H. Aghazarian, and E. Baumgartner, "Sustainable Cooperative Robotic Technologies for Human and Robotic Outpost Infrastructure Construction and Maintenance," Autonomous Robots, 20(2): 113-123, 2006.

Primary Discipline: Computer Science

Secondary Discipline: Systems Engineering

Other Discipline:

Hazard: NONE

Hazard Chemical:

Hazard Others:

AO# 7594

Project Title: PDS Imaging Node Image Atlas Search Enhancements

Background Information: The Imaging Node (IMG) of the NASA Planetary Data System (PDS) is the home to over 700 TB of digital image archives, making it one of the richest data repositories for planetary imagery in the world. The Planetary Image Atlas provides access to the entire collection of IMG data through links to online holdings and data node catalogs, enabling users to make scientific discoveries. Because of the immense volume of planetary imagery, the problem arises with remaining in sync with new missions and the data available through the Atlas. By developing an automated pipeline for metadata ingestion for newer missions, it will minimize the cost associated with ensuring data is in sync.

Project Description: The candidate will be tasked with leveraging a BPMN-like software package to verify and ingest product metadata for missions not currently accessible through the Atlas, like New Horizons, Dawn, Rosetta, EPOXI, etc. This will involve the parsing of product metadata, verification of data integrity, ingestion into Solr indexes, and processing of raw and derived data products into web-viewable image formats.

Suggested and/or Required Background & Skills: Required: Unix/Linux, Python/Java, Eclipse IDE Suggested: BPMN, GDAL, software engineering course work, understanding of image formats

Web or Literature References: Planetary Image Atlas - http://pds-imaging.jpl.nasa.gov/search/ . PDS Imaging Node - http://pds-imaging.jpl.nasa.gov/ . BPMN - https://en.wikipedia.org/wiki/Business_Process_Model_and_Notation The VICAR Image Processing System - http://www-mipl.jpl.nasa.gov/external/vicar.html . USGS ISIS: Integrated Software for Imagers and Spectrometers - https://isis.astrogeology.usgs.gov/ . GDAL - Geospatial Data Abstraction Library - http://www.gdal.org/ .

Primary Discipline: Computer Science

Secondary Discipline:

Other Discipline:

Hazard: NONE

Hazard Chemical:

Hazard Others:

AO# 7586

Project Title: Graphics design and business assistance to the robotic mobility group at JPL

Background Information: Robotic mobility group designs novel mobility systems and out of the box concepts for space vehicles. These concepts need to be visualized in an intuitive way. This needs creating high-quality simulations, graphics, presentations, and videos to convey the complex ideas to readers/audience.

Project Description: The intern will support the robotic mobility group in creating high-quality graphics that depict complex robotic mobility concepts and concept space vehicles. The intern further will support the team on preparing high-quality technical art embedded in technical presentations, documents, and videos.

Suggested and/or Required Background & Skills: Required: Experience with software for drawing technical figures. Strong written and verbal communications skills Suggested: Experience with graphic design software Web Development Experience Experience with Technical illustration, Word processing and document formatting Experience with Making Videos Experience with simulation and game environments

Web or Literature References:

Primary Discipline: Computer Science

Secondary Discipline: Information Systems/Technology

Other Discipline: Mechanical Engineering, Aerospace Engineering

Hazard: NONE

Hazard Chemical:

Hazard Others:

AO# 7512

Project Title: M2020

Background Information: Following upon the success of the Curiosity rover, NASA plans to launch another Curiosity-like rover to Mars in 2020. This fits into the Mars Exploration Program's overall objective to "Seek Signs of Life". The Mars 2020 project, currently in Phase C, is working towards a Systems Integration Review in Fall 2017.
Project Description: Assist the Project System Verification and Validation team by working with system engineers to develop and execute test procedures, report on progress, audit and closeout Verification and Validation items. In addition, may create widgets to generate metric reports using the Jazz Tool Suite to reflect the state of progress regarding the Verification and Validation effort (examples are how many items are open/closed/in progress, how many procedures are released, etc)
Suggested and/or Required Background & Skills: Engineering-related courses, especially in Aerospace. Familiarity with Curiosity and Mars 2020 objectives. Requirements development / management and V&V experience are helpful, not required.
Web or Literature References: http://mars.jpl.nasa.gov/programmissions/overview/
Primary Discipline: Aerospace Engineering
Secondary Discipline: Systems Engineering
Other Discipline: Mechanical, Electrical or Related Engineering
Hazard: NONE
Hazard Chemical:
Hazard Others:

AO# 7432

Project Title: Design and Control of prototype vehicles for Mars navigation

Background Information: Rovers are slow on Mars and their mobility is limited to flat surfaces. Flying vehicles can fly over obstacle-laden environments but they suffer from short flight-time.

Project Description: In this project, we design particular vehicles that have two modes of flying in the air and moving on the Mars surface.

Suggested and/or Required Background & Skills: The student will help with the mechanical design of the vehicle (based on an already-designed concept in JPL). Past experience with quadcopter is a plus. The student will collaborate with researchers at JPL fabrication shops; he/she will also help with basic calculations on the weight, material selection, etc.

Web or Literature References:

Primary Discipline: Aerospace Engineering

Secondary Discipline: Mechanical Engineering

Other Discipline:

Hazard: Robotics

Hazard Chemical:

Hazard Others:

AO# 7431

Project Title: Machine learning for robot navigation (prototype for Mars robots)

Background Information: Deep Learning has shown a huge success in recent years. The applications ranges from object recognition, speech recognition, to planning and control. Navigation on Mars is a complex task that can benefit from machine learning techniques in general, and deep learning, in particular.

Project Description: In this project, we would like to explore the application of deep learning-based methods to rover navigation on Mars. A lot of generic open-source libraries have been developed for deep learning and are freely available on the web. We would like to feed our data from the years of navigating rover on Mars to one of these open-source software. And try to learn the navigation rules and achieve a higher level of autonomy for the rover and avoid hazards and failures on Mars.

Suggested and/or Required Background & Skills: The SIRI students' role is to closely collaborate with Mars rover operators, gather the existing data from previous rover navigation on Mars. Then, the student will train a deep neural network using existing free software on web. Finally, we test the trained navigation system by feeding the new images from the after-training runs and compare the generated path with the path, provided by the operator. If the progress is fast, we will port the method to a physical robot to test in JPL's Mars yard. We will use openAI gym as the simulation and training system: https://gym.openai.com/

Web or Literature References: We will use openAI gym as the simulation and training system: https://gym.openai.com/

Primary Discipline: Computer Science

Secondary Discipline: Computer Engineering

Other Discipline:

Hazard: NONE

Hazard Chemical:

Hazard Others:

AO# 7372

Project Title: Optical and RF Spacecraft Downlink Signal Processors

Background Information: The Deep Space Network (DSN) is responsible for maintaining reliable communications with various NASA spacecraft. By recording the spacecraft data, analysts are able to process the data with new algorithms and provide new capabilities for the DSN. In order to support this task, parallelized processing algorithms, software and firmware must be developed.

Project Description: The candidate will work with engineers and analysts to develop and implement algorithms on cloud computing and GPU platforms. The candidate will work with engineers and analysts to extend the capabilities of an existing software algorithm suite used to process radio downlink signals from spacecraft (RF and Optical). This task may also include the development and testing of synchronization algorithms related to optical communication and optical arraying. This task may also include the testing of a high rate 640Msps firmware receiver and decoder as well as extending its capabilities. In addition, the candidate may also work on developing and testing network frameworks for future CubeSat missions. The candidate may also be directed to support additional tasks at the direction of the mentor.

Suggested and/or Required Background & Skills: Strong background in electrical engineering, computer science; Experience in Linux, C/C++, Matlab, Verilog / VHDL/System Verilog,Cuda,OpenACC

Web or Literature References: Required: strong background in electrical engineering, computer science; Experience in Linux, C/C++, Matlab, Verilog / VHDL/System Verilog,Cuda,OpenACC

Primary Discipline: Electrical Engineering

Secondary Discipline: Computer Engineering

Other Discipline: Computer Science

Hazard: NONE

Hazard Chemical:

Hazard Others:

AO# 7333

Project Title: Next generation miniturized high spectral resolution spectrometers study

Background Information: We can't put high-resolution spectrometers in space because they are huge, and they require large aperture telescopes. There is a new class of spectrometry that can obtain high spectral resolution spectra at wide FOV using small aperture telescopes. These instruments are a very useful technique for studying extended astronomical targets like comets, and planetary atmospheres. And because of their compact size, they fit into smallsats which have a huge application for high-resolution spectrometry space exploration.

Project Description: The student will work closely with two mentors to investigate the signal and noise propagation in the instrument and create the single to noise ratio Python model. Using this model, we would be able to see which science objectives would be possible to observe using this instrument and what is the performance of the system. This project is not an easy task, but the student will have great advice and regular interaction with the advisors to complete a very exciting and interesting project. The student will learn in great detail about how astronomical instrumentations, in particular spectrometers and interferometers work and would be able to apply her/his knowledge to a very broad range of astronomical instrumentation in future.

Suggested and/or Required Background & Skills: Skilled is coding in Python or similar languages Creating data base creating presentation plots and trajectories from the data base

Web or Literature References:

Primary Discipline: Computer Science

Secondary Discipline: Physics/Applied Physics

Other Discipline: Spectrometers, astronomy, astronomical instruments

Hazard: NONE

Hazard Chemical:

Hazard Others:

AO# 7328

Project Title: DopplerScatt â€“ Real-time radar image display

Background Information: DopplerScatt is a radar capable of simultaneous measurements of the ocean surface currents and winds. The radar is deployed from a small aircraft while operated by a radar operator. The operator has visual indicators of various system health parameters and basic performance indicators. However, there is currently no real-time display of radar image data as its being collected.
Project Description: The project scope encompasses the following tasks: 1. Write Python software, which interfaces with hardware and the existing software framework to continuously display and update the received echoes from the Earth surface during flight. 2. Test the software operation on the radar itself and verify that all of the interfaces are operating correctly without significantly slowing the processing computer or the existing GUI updates. 3. Verify softwareâ€™s display and update capabilities using either an existing data set in a flight simulation environment (which would also be developed) or during an engineering flight if the opportunity arises in the internship time frame.
Suggested and/or Required Background & Skills: Computer Programming experience is a must, since the goal of the project is to develop software. Java, C, C++, etc. experience acceptable, Python preferred.
Web or Literature References:
https://esto.nasa.gov/forum/estf2014/presentations/B5P4_Rodriguez.pdf
https://esto.nasa.gov/forum/estf2015/presentations/Perkovic-Martin_A3P4_ESTF2015.pdf
Primary Discipline: Computer Engineering
Secondary Discipline: Earth Science
Other Discipline: Radar Remote Sensing
Hazard: NONE
Hazard Chemical:
Hazard Others:

AO# 7322

Project Title: Mars Data Analysis

Background Information: The Jet Propulsion Laboratory is seeking highly motivated undergraduate students to participate in Mars data analysis focused on information returned by the Mars Global Surveyor, Mars Odyssey, the Mars Reconnaissance Orbiter spacecraft, and the Mars Exploration Rovers. Data to be studied will be from the Mars Orbiter Camera (MOC), Mars Orbiter Laser Altimeter (MOLA), Thermal Emission Spectrometer (TES), Thermal Emission Imaging System (THEMIS), High Resolution Imaging Science Experiment (HiRISE), the Context Imager (CTX), and instruments of the Mars Exploration Rover Athena Science Payload.

Project Description: Work will be directed at characterizing the geology and safety of candidate landing sites for future Mars missions, including the NASA Discovery Program, InSight mission to land on Mars in 2016 and the Mars 2020 Rover. Safety issues focus on quantification of slopes of concern for landing safely in potential landing sites using MOLA data and digital elevation models from stereo images. Work will also be related to measuring rocks on the surface of Mars and understanding their context. This will include analyzing rocks visible in high-resolution HiRISE images and quantifying their size-frequency distribution to better understand landing safety. HiRISE and CTX images will also be georeferenced to lower resolution images (CTX, THEMIS) and topographic maps (MOLA). Additional work may include analyzing craters on Mars to investigate rock distributions in their ejecta, how they change with time and their morphologic state as well as the geomorphology as a clue to the subsurface geology.

Suggested and/or Required Background & Skills: Most of the work will be done on personal computers utilizing mixed operating systems (Macintosh and Windows), so experience with them is important. The ability to measure and tabulate rocks, place the data into standard spreadsheets, and plot the results is required for the work on rock distributions. Experience with ArcGIS mapping software (10.x), especially georeferencing imagery, is preferred as our landing site data is specifically formatted to work with this GIS package. Additional knowledge of Integrated Software for Imagers and Spectrometers (ISIS 3.x), SOCET SET, or Matlab software would be a plus. Preference will be given to students with backgrounds in geology or planetary science and other related disciplines such as geographic information science, physics, chemistry, astronomy, engineering, and computer sciences. The students will spend most or all of their time at JPL. They may be supervised by one or two research scientists and may also work alongside other researchers and students.

Web or Literature References: Information on the Mars landing sites and selection can be found at: Golombek, M. P., et al., 2003, Selection of the Mars Exploration Rover landing sites: Journal of Geophysical Research, Planets, v. 108(E12), 8072, doi:10.1029/2003JE002074, 48pp. Golombek, M., et al., 2005, Assessment of Mars Exploration Rover landing site predictions: Nature, v. 436, p. 44-48 (7 July 2005), doi: 10.1038/nature03600. Golombek, M. P., et al., 2006, Erosion rates at the Mars Exploration Rover landing sites and long-term climate change on Mars: Journal of Geophysical Research, Planets, v. 111, E12S10, doi:10.1029/2006JE002754. Golombek, M. P., and McSween Jr., H. Y., 2007, Mars: Landing site geology, mineralogy and geochemistry: Chapter 17, p. 331-348, in Encyclopedia of the Solar System, Second Edition, L. A. McFadden, P. R. Weissman and T. V. Johnson, eds., Academic Press/Elsevier, San Diego, 966 pp. Golombek, M. P., et al., 2008, Martian surface properties from joint analysis of orbital, Earth-based, and surface observations: Chapter 21 in, The Martian Surface: Composition, Mineralogy and Physical Properties, J. F. Bell III editor, Cambridge University Press, p. 468-497. Golombek, M., K. Robinson, A. McEwen, N. Bridges, B. Ivanov, L. Tornabene, and R. Sullivan, 2010, Constraints on ripple migration at Meridiani Planum from Opportunity and HiRISE observations of fresh craters, J. Geophys. Res., 115, E00F08, doi:10.1029/2010JE003628. Golombek, M., et al., 2012, Selection of the Mars Science Laboratory landing site: Space Science Reviews, v. 170, p. 641-737, DOI: 10.1007/s11214-012-9916-y. Golombek, M., Redmond, L., Gengl, H., Schwartz, C., Warner, N., Banerdt, B., and Smrekar, S., 2013,

Selection of the InSight landing site: Constraints, plans, and progress (expanded abstract)?: 44th Lunar and Planetary Science, Abstract #1691, Lunar and Planetary Institute, Houston. Golombek, M., Warner, N., Schwartz, C., and Green, J., 2013, Surface characteristics of prospective InSight landing sites in Elysium Planitia (expanded abstract)?: 44th Lunar and Planetary Science, Abstract #1696, Lunar and Planetary Institute, Houston. Golombek, M. P., et al., 2014, Small crater modification on Meridiani Planum and implications for erosion rates and climate change on Mars: Journal of Geophysical Research, Planets, v. 119, p. 2522-2547, 10 Dec. 2014 Rock distributions and their importance in landing site selection can be found in: Golombek, M., and Rapp, D., 1997, Size-frequency distributions of rocks on Mars and Earth analog sites: Implications for future landed missions: Journal of Geophysical Research, Planets, v. 102, p. 4117-4129. Golombek, M. P., et al., 2003, Rock size-frequency distributions on Mars and implications for MER landing safety and operations: Journal of Geophysical Research, Planets, v. 108(E12), 8086, doi:10.1029/2002JE002035, 23pp. Golombek, M. P., et al., 2006, Geology of the Gusev cratered plains from the Spirit rover traverse: Journal of Geophysical Research, Planets, v. 110, E02S07, doi:10.1029/2005JE002503. Golombek, M. P., et al., 2008, Size-frequency distributions of rocks on the northern plains of Mars with special reference to Phoenix landing surfaces: Journal of Geophysical Research, Planets, v. 113, E00A09, doi:10.1029/2007JE003065. Golombek, M., Huertas, A., Kipp, D. and Calef, F., 2012, Detection and characterization of rocks and rock size-frequency distributions at the final four Mars Science Laboratory landing sites: Mars, v. 7, p. 1-22, doi:10.1555/mars.2012.0001.

Primary Discipline: Planetary Science
Secondary Discipline: Earth Science
Other Discipline:
Hazard: NONE
Hazard Chemical:
Hazard Others:

AO# 7291

Project Title: Improving Deep Space Network Operations

Background Information: The Operations Lab creates the software that is used to command all JPL spacecraft (like Curiosity rover), ranging from desktop to AR and VR systems. As a human centered part of the Ops Lab, the Human Interfaces (HI) group researches, designs, prototypes and develops the ways users interact with these systems. The HI group has many opportunities for interns and full-time professionals in these areas: User Research HI Group User Researchers direct efforts to ground development in observation and evidence. User researchers define critical unknowns, and develop plans to study, interpret and document user needs. User Researchers gather information using user-centered design methods, including but not limited to contextual inquiry, artifact walkthrough, and interviews. They synthesize results and provide design direction. Then, they validate the direction using needs validation, prototype walkthrough, and user evaluation techniques. Interaction Design HI Group Interaction Designers direct efforts to evaluate and translate user needs into actionable insights and system capabilities. They rapidly prototype and evaluate paper and software prototypes, and simulation and role play. Visualization HI Group Visualization Developers direct efforts to create software that allows scientists and engineers to move, parse, analyze, interact with, and share discoveries with the massive data NASA instruments and spacecraft generate every day. They build systems that merge alien landscapes with ambiguous sensor data, create new kinds of interactive maps, and express complex robotic controls in compact visual language.

Project Description: The Deep Space Network hopes to change its operations in a way that will help increase efficiency and improve operations. The Human Interfaces group has been tasked with conducting user research and prototyping of initial concepts to support this new method of operations. Interns will work with team members of the Human Interfaces group to conduct user research, sketch and prototype new ideas, program design solutions, and iteratively test ideas with other designers and with real operators of the Deep Space Network. The goal of this internship will be to help move the project forward as well as give valuable industry experience to interns.

Suggested and/or Required Background & Skills: Desired skills: - Experience with user-centered design - Experience working in a collaborative, iterative development environment - Human Computer Interaction (HCI) project experience - User interface or user experience (UI/UX) design experience - Graphic design, illustration, drawing - Web front end design and/or implementation

Web or Literature References: http://www.youtube.com/opslabjpl http://deepspace.jpl.nasa.gov

Primary Discipline: Computer Science

Secondary Discipline: Undecided

Other Discipline: Interaction Design

Hazard: NONE

Hazard Chemical:

Hazard Others:

AO# 7290

Project Title: Analysis of Near- and Mid-Infrared Observations of Jupiter and Saturn

Background Information: Images and spectra of Jupiter and Saturn from near- and mid-infrared instruments are sensitive to temperatures, abundances of a major condensate (ammonia), opacity of clouds with large particles, and the variability of the molecular para- vs ortho-hydrogen ratio. These define the fundamental state of the atmosphere and constrain its dynamics. This research will focus on observations obtained from a variety of instruments: MIRSI, NSFCam, and SpeX (NASA Infrared Telescope Facility), T-Recs (Gemini South Telescope), VISIR (ESO's Very Large Telescope), and COMICS (Subaru Telescope). These observations consist primarily of radiometrically filtered images. Much of these data sets have been reduced already, and the primary task of the student will be to format the data appropriately as input to an atmospheric retrieval code from which the various properties will be derived. Prioritized specific areas of investigation are given below.

Project Description: a. We will be working with a large-volume set of observations of Jupiter, both imaging and spectroscopy, that are designed to support observations of Jupiter scheduled from various instruments on the New Frontiers Juno spacecraft. It will be important to reduce and, if possible, analyze these results and report them to the Juno science team during the course of the mission. b. We want to examine long-term behavior of planetary temperatures and distribution of minor constituents using archival through current thermal images that were taken from 1995 to the present. These include some of the behaviors noted below, but the data are to be examined also in a more general sense for unexpected events or phenomena unrelated to changes that are detectable in the visible. A substantial amount of this work was completed through 2010 data by a previous student, and the task will involve corrections to the calibration of the data, combined with their interpretation to be put immediately into a publication in the open literature. c. The last few years have found Jupiter in a state described as one of "global upheaval", during which substantial and rapid changes are observed in the state of its visually prominent axisymmetric regions. Most recently Jupiter's normally dark North Temperate Belt (NTB) turned bright around 2002-2003 and in 2007 suddenly darkened again, coupled with the activity of two massive atmospheric plumes. Its normally dark South Equatorial Belt (SEB) lightened early in 2007 and then darkened later that year; late in 2009 it lightened again. This task will be to examine whether there are temperature changes associated with these visual metamorphoses, even preceding them, along with variations of their dynamical states - tracked through clouds and chemical species - as a means of understanding whether large-scale dynamics are responsible or whether they can be explained by small changes of elevation that induce phase changes in the chemicals that color the clouds. d. An effort related to (b) above is to note whether there are temperature or compositional changes associated with the re-darkening of the South Equatorial Belt (SEB) that began in November of 2007 in a series of spectacular events. Some early work on this will be accomplished by a student in the spring of 2011, but there will be much work left over. e. For Saturn, besides the long-term response to seasonal variations of radiation, we are investigating the appearance of thermal wave trains in the atmosphere. f. For Saturn, we are examining the persistence and frequency of 'patchy' thick clouds in its upper atmosphere that were detected by observations of thermal emission from deep clouds.

Suggested and/or Required Background & Skills: The data reduction programs are written in the Interactive Data Language (IDL, which is close to Matlab in format). The analysis code is written in FORTRAN. At least rudimentary knowledge of these (or willingness to learn before the beginning of the research) is highly recommended. At least some programming experience is required of serious candidates. With a significant level of contribution, students are welcomed as co-authors on papers emerging from this research.

Web or Literature References: Data reduction and the retrieval process are described by Fletcher et al. (2009, Icarus 200, 154). a. Little work has been done on Jupiter in the past, but we did a similar study for Saturn, discovering a long-term (~15-year) wave phenomenon (Orton et al. 2008, Nature 453, 196). b. See Sanchez-Lavega et al. (2007, Nature 251, 437) for an introduction to our initial work in this area. c. Nothing has been done on this phenomena in the thermal. An account of the visible changes of the atmosphere were reviewed by Sanchez-Lavega and Gomez (1996, Icarus, 121, 1). d. We detected thermal waves in Saturn initially in 2003 from Keck Telescope data (Orton et al. 2005 Science 307, 696). e. Our initial work in this area was described by Yanamandra-Fisher et al. (2001, Icarus 150, 189).
Primary Discipline: Planetary Science
Secondary Discipline: Astronomy/Astrophysics
Other Discipline: Computer Sciences
Hazard: NONE
Hazard Chemical:
Hazard Others:

AO# 7287

Project Title: Memory Device Reliability

Background Information: Flash memory is utilized for storage of information in most missions. Since our applications are quite different from the intended applications of these components, it is crucial that we understanding of how well these devices perform in space environments to ensure their reliability for our particular applications.

Project Description: We will be studying flash memory devices and Resistive memory devices to understand underlying device physics of failure statistics as impacted by temperature, wear and radiation to develop appropriate models and design mitigation

Suggested and/or Required Background & Skills: programming C++, Linex, breadboard building, semiconductor device, testing experience highly desirable. Matlab, data analysis

Web or Literature References: www.micron.com, www.hynix.com, www.samsung.com, Fujitsu.com

Primary Discipline: Electrical Engineering and Computer Science

Secondary Discipline: Materials Engineering

Other Discipline:

Hazard: Soldering

Hazard Chemical:

Hazard Others:

AO# 7284

Project Title: PIXL Prototype Instrument Characterization and Sample Analysis

Background Information: PIXL (Planetary Instrument for X-ray Lithochemistry) is an X-ray fluorescence spectrometer on the Mars 2020 rover payload. As the PIXL team builds and tests the prototype and hardware, and prepares for Mars operations, we will be conducting a large array of sub-system performance and characterization tests.

Project Description: The successful applicant will have a background in geology and an interest in the planetary evolution of Earth and Mars. This role requires a demonstrated ability to learn and work independently. Experience in XRF, ICPMS and other geological sample analysis is desirable, as is spectral data analysis skills using ENVI, Igor or similar. Alternatively, programming skills in Python and/or IDL are required. This project involves analyzing geological samples using PIXL hardware under mission analogue conditions. The student may bring their own samples in support of an existing research project if desired. The student will process and analyze the datasets in order to inform PIXL development.

Suggested and/or Required Background & Skills: â€¢ Strong interest in geology. â€¢ Strong analytical skills and willingness to learn new skills. â€¢ Sound understanding of the scientific method and an interest in developing and testing hypotheses. â€¢ A self-motivated individual who can work independently and in a team environment.

Web or Literature References: http://ieeexplore.ieee.org/document/7119099/?section=abstract

Primary Discipline: Earth Science

Secondary Discipline: Computer Science

Other Discipline:

Hazard: Electrical Equipment (50V and above),Laser,Ionizing Radiation

Hazard Chemical:

Hazard Other: