

# Physics & Astronomy Department Newsletter

## Vol. 3, No. 1 (Fall 2016)



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ST. CLOUD STATE  
UNIVERSITY

Mission: Apply theoretical, computational, observational, and experimental methods to explore and understand the natural world.

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### Message from the Chair:

Fiscal year 2017 is well underway and many things are happening in the department. We are pleased to have a new fixed term faculty member and condensed matter theorist, Dr. Christofer Nelson, who joined us in August 2016 to support the physics and graduate materials science programs. Dr. Gary Bohannon has retired from teaching at SCSU and moved to Memphis to be with family. Best wishes to Gary in this new chapter in his life. Dr. John Harlander retired from teaching as of May 2015. John has been an outstanding classroom instructor and a world-class research optical physicist, making a positive impact on the department for nearly 25 years. John is maintaining laboratory activities connected with the impressively well-funded ICON project of developing optical instrumentation for upper-atmospheric EM storm forecasting. Thank you John, and best wishes in this new phase of professional and personal activities.

Returning fixed term faculty teach a full load of classes, yet find time to engage in outreach and service. We are excited at the upcoming April 3<sup>rd</sup> visit and presentation by astronomer Phil Plait (author of *Bad Astronomy*) in Ritsche Auditorium, arranged by Dr. Todd Vaccaro. Dr. Elisha Polomski worked tirelessly to secure permission and media to show the movie "Hidden Figures" on campus Feb. 22 and 23. The movie is a smash hit at the box office and is nominated for awards. Thank you for your work to make these exciting events happen.

The Physics & Astronomy Club is active this year in outreach and recruiting, including Red & Black Days for prospective students, Science Rocks, Tech Savvy, and Horizons events for young science enthusiasts, and the Regional Science Fair on Feb. 25. The club is planning a field trip over spring break to visit a neutrino experiment and tour the facilities. Have a great trip, physics enthusiasts!

Several faculty (Dr. Sinko, Dr. Liu, and Dr. Polomski) sought internal funding for research endeavors and are eager to work with students. Look for at the upcoming Student Research Colloquium, April 18, 2017.

For further information about curricular offerings, research activities, or outreach and service activities, please contact the Physics and Astronomy Department at 320-208-2011.

Thank you to the students, the staff, and the faculty for making this a collegial and pleasant place to work and grow.

Best wishes for rewarding experiences learning and doing science.

-Kevin

Dr. Kevin Haglin  
Professor and Chairperson, Dept. of Physics and Astronomy  
St. Cloud State University



**Photo (above)** ISELF building at sunset

Editor: Dr. John E. Sinko. Send stories to [jesinko@stcloudstate.edu](mailto:jesinko@stcloudstate.edu) or Physics Department Newsletter, 309 Wick Science Building, SCSU, 720 4<sup>th</sup> Ave. South, St. Cloud, MN 56301

## The Physics and Astronomy Club

### Outgoing Officers (2015-2016)

President	Travis Hislop
Vice President	Alexis Corbett
Secretary	Meredith Rupp
Treasurer	Chris Crawford
Public Relations	Jason Poepke

### Incoming Officers (2016-2017)

President	Alexis Corbett
Vice President	William Julius
Treasurer	Michael Rogers
Secretary	Meredith Rupp
Public Relations	Travis Hislop

### Faculty Advisors

2015-2016: Dr. Todd Vaccaro and Dr. Zenqiang (John) Liu      2016-2017: Dr. Elisha Polomski and Dr. Todd Vaccaro

### Active Members

Sutapa Biswas, Alexis Corbett, Chris Crawford, Travis Hislop, William Julius, Anthony Kunkel, Brian Leyendecker, Jason Poepke, Richard Preusser, Michael Rogers, Meredith Rupp, Rita Schwieters, Joseph Sperling, James Sweeney, Lucas Winkelman

### Major Activities in the 2015-2016 Year:

#### FERMILAB TRIP



10/8-11/2015      Trip to Fermilab (from left to right in below photo: E. Jensen, W. Julius, C. Stein, A. Corbett, C. Crawford, S. Biswas, N. Rasheed, J. Poepke (back), R. Schwieters (front), B. Leyendecker, T. Hislop (back), L. Winkelman (front), Dr. J. Sinko)

#### ANNUAL PUMPKIN DROP



10/30/2015      **Left:** Rita Schwieters and Dr. Polomski prepare to drop pumpkins. **Middle:** Rita surveys the pieces. **Right:** Drs. Polomski and Sinko goofing around

### Contact Us!

Join the club! Reach us on Facebook (SCSU Physics & Astronomy Club) or email: [phy\\_astr@stcloudstate.edu](mailto:phy_astr@stcloudstate.edu)

## **Student Recognitions (2015-2016)**

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### **Graduating Physics & Astronomy Majors (2015-2016)**

**Fall 2015**               Dustin Gilyard  
                              Travis Ingvarsson  
                              Rita Schwieters  
                              Michael Severson  
**Summer 2016**       James Sweeney

### **Graduating Physics & Optics Minors (2015-2016)**

**Spring 2016**           William Muench (Optics minor)

### **Dean's List**

Dean's List, Fall 2015       John Corcoran I-Physics       Bishnu Sharma I-Physics  
                                      Adam Wallin   Physics Education  
Dean's List, Spring 2016   John Corcoran I-Physics

### **2015 Physics Scholarships (2015-2016)**

William Julius (Physics)       and       Meredith Rupp (Physics/Math)

### **Student Research for Credit (PHYS 415 courses) in the 2015-2016 Academic Year**

#### **Fall 2015**

Sutapa Biswas           Prof. Sinko       Magnetic Mirrors and Plasma Trapping  
Clinton Dawson       Prof. Lee       The New Space Race

#### **Spring 2016**

Tyler Baxter           Prof. Sinko       Laser Propulsion Propellant Development  
Christopher Crawford   Prof. Polomski   Photometry and Multiwavelength Analysis of a Star Formation Region  
William Julius       Prof. Sinko       High Voltage Electric Modification  
Michael Rogers       Russ Lidberg     Pump Probe Spectroscopy

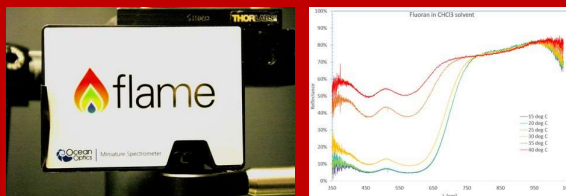
*We strongly encourage students to get involved in undergraduate research!*



## New Equipment from Dean's Equipment Fund, Fall 2015

### Laboratory Spectrometers

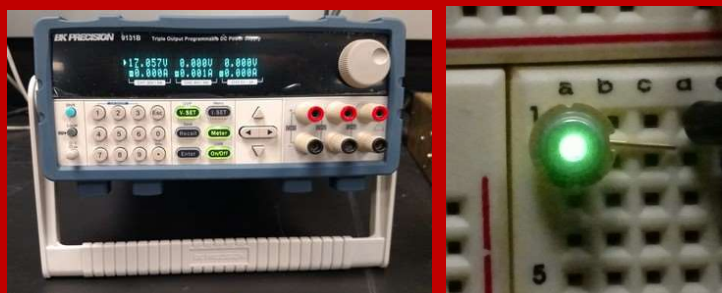
A collaborative effort by Drs. Liu and Sinko culminated in the acquisition of 2 Ocean Optics USB laboratory spectrometers worth about \$ 6,500 for the SCSU Physics & Astronomy Department, via the Dean's Equipment Fund for the College of Science & Engineering.



These devices are now in use in student research and laboratory activities, for example in PHYS 333 Optics and PHYS 430/432 Advanced Lab. The new devices already supported a formal student conference proceedings paper.

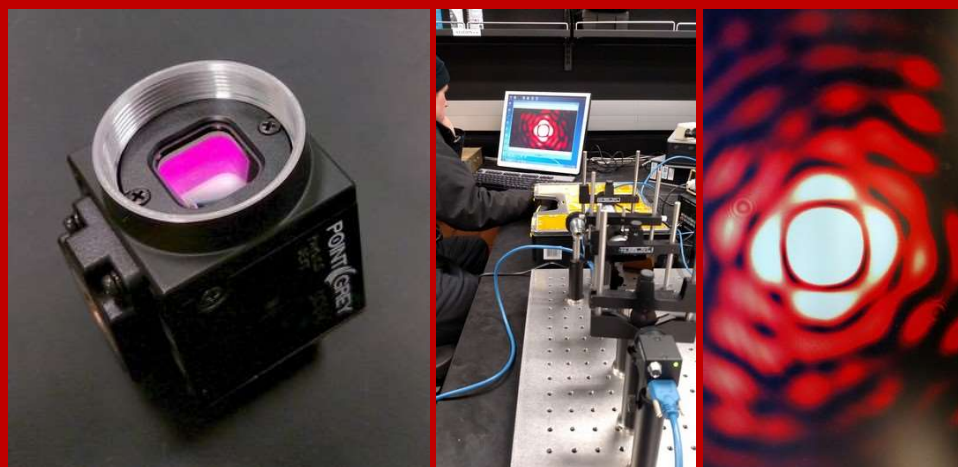
### Digital Power Supplies

Dr Sinko's proposal to replace the aging analog power supplies in the ISELF 21 optics lab with digital power supplies was approved for roughly \$ 15,000. A set of ten BK Precision supplies with dual 30V, 6A outputs and a third 5V, 3A output were procured and distributed with one supply at each of the ten optics stations. These have already used this year in new labs for ENGR 425 and MATS 631 exploring current-voltage and power curves for LEDs and laser diodes.



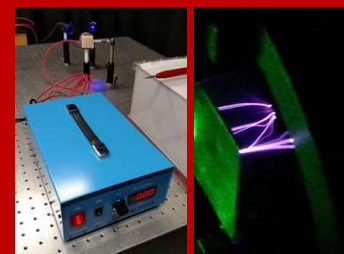
### 'Machine Vision' / Laboratory Cameras

Dr Sinko's proposal to outfit the ISELF 21 optics lab with digital power supplies was approved for purchase from the Dean's Equipment Fund. A set of ten cameras worth about \$ 8,500 is now available for optics and advanced optics labs.



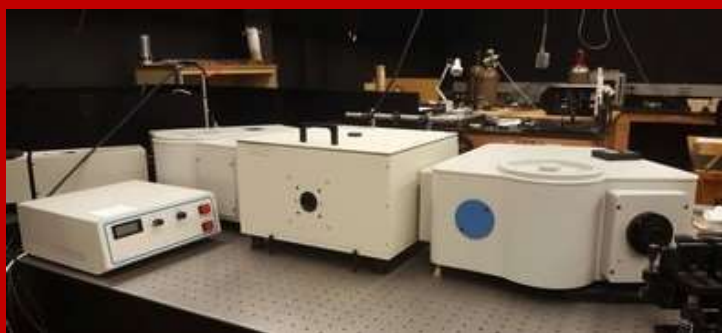
### 30 kV DC Power Supply

A roughly \$3,000 high-voltage benchtop research power supply adjustable to 30 kV was purchased using the Dean's Equipment Fund based on a proposal by Dr. Sinko, and will support research and/or advanced laboratory experiments.



### Monochromator and Associated Instrumentation

Russ Lidberg's Dean's Equipment Fund proposals for research optics equipment including 2 monochromators, tungsten light source, and sample compartment were approved for around \$30,000. This equipment will be used to support student research in the Brown Hall 318 space. The equipment will be used in Advanced Lab and for advanced photonics projects.



## Department News and Events, Fall 2015...Summer 2016

### SCSU Professor Names Exoplanet



During the 2015-2016 year, the Astronomy faculty of SCSU engaged in a competition held by the International Astronomical Union to name exoplanets in 20 systems. Naming submissions were opened to the public, and 10 local submissions were entered in the competition. Prof. Vaccaro's submission "Dagon" was selected from 16 finalist submissions worldwide, and as of 25 December 2015, will be the new name for the exoplanet Formalhaut b. Dagon is a fishlike demigod featured in the fictional horror works of H. P. Lovecraft. Congratulations, Dr. Vaccaro!

### New Doorway and Screen

October 2015 saw a red panel painted outside the department office, followed shortly by the installation of a television monitor in the hallway for physics news.



### Stanford Geant4 C++ Training at MIT

Dr. Ratliff attended a four-day (June 20-23, 2016) tutorial at the Massachusetts Institute of Technology on Geant4, a C++ toolkit for radiation transport calculations. The workshop was put on by scientists from the Stanford Linear Accelerator Laboratory (SLAC).

### Dr. Polonski Brings Moon Rocks to SCSU

In October, Dr. Polonski, via her NASA connections, brought a set of Moon rock samples to SCSU campus. Along with some very interesting meteorite samples, these were of high interest to students and faculty from Physics and Chemistry.



### Laser Shows in the SCSU Planetarium

Over the fall term, Dr. Vaccaro arranged a second series of laser light shows in the planetarium. These shows merge popular music with astronomical imagery in an effort to advertise the department and reach out to local businesses to support the planetarium. The department is interested to see if the activity results in any significant recruitment from the St. Cloud area.





## Faculty Professional News, Fall 2015...Summer 2016



### Emeritus Faculty: Dr. John Harlander

Prof. John Harlander has graduated to Professor Emeritus status as he transitions to more research focused activities. In the near-term, he will be traveling frequently supporting the NASA-sponsored ICON satellite project on which he is a co-investigator. Locally his research laboratory has moved to Brown Hall 317 where he and his students are making upper atmospheric wind measurements and developing prototype interferometers for possible future space programs. Prof. Harlander has taught introductory physics and upper level optics and physics courses at SCSU since 1991.

### Retirement: Dr. Gary Bohannon

Prof. Gary Bohannon retired from the SCSU Physics & Astronomy department in June 2016 after four years of teaching with the department. He was well-liked by the Physics & Astronomy major students and taught with coffee-fueled energy and enthusiasm. He strongly encouraged student research active engagement in classes, critical thinking, and physics club field trips. He remains a strong proponent of fractional calculus.



### New Fixed Term Faculty: Dr. Christofer Nelson

Dr. Nelson will be joining the department for the Fall 2016-Spring 2017 year.

*"I joined the faculty here in order to provide a theoretical component to the research needs of the department in terms of the materials science graduate program, as well as to teach undergraduate courses for majors and non-majors. My Ph.D. is from the University of Utah in condensed matter theory. I enjoy exploring non-equilibrium statistical mechanics, and non-linear optics."*

### Campus Laser Safety Officer: Dr. John Sinko

In Fall 2015, Dean Gregory appointed Dr. John Sinko to act as SCSU's Laser Safety Officer in addition to his regular duties. An LSO is required at all institutions operating class 3B and/or class 4 lasers. Dr. Sinko will be responsible for coordinating with the SCSU Laser Safety Committee, monitoring high power (class 3B and 4) laser usage on campus, keeping a high-power laser inventory, conducting campus laser safety training, bringing SCSU laser spaces up to OSHA standard, helping to develop standard procedures for laser use, etc. The Dean's office also purchased the ANSI Z136.1 standard (which governs general laser use) and the Z136.5 standard (which governs laser use in educational institutions). These resources are currently located in ISELF 21. If you need laser advice, assistance, or training, please contact Dr. Sinko!



**Faculty, Fall 2015...Summer 2016**

**Dr. Sneh Kalia**

Professor, Physics



Physics

**Dr. Kevin Haglin**

Professor, Physics  
Department Chair



Theoretical Physics

**Dr. Zengqiang (John) Liu**

Associate Professor, Physics



Experimental Physics

**Dr. Steven Ratliff**

Professor, Physics  
Director of Rad Tech, Nuc Med Tech Programs



Medical Physics, Radiation Transport

**Prof. Annette Lee**

Associate Professor, Astronomy  
SCSU Planetarium Director



Astronomy

**Dr. John Sinko**

Assistant Professor, Physics  
SCSU Laser Safety Officer



Experimental Physics, Optics, Materials

**Dr. Todd Vaccaro**

Assistant Professor, Physics



Astrophysics, Astronomy

**Dr. Gary Bohannon**

Assistant Professor, Physics



Experimental Physics, Fractional Orders

**Dr. Elisha Polomski**

Assistant Professor, Physics



Astrophysics, Astronomy



## Faculty Publications, Fall 2015...Summer 2016

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- **A. Lee**, "The Cosmos as Viewed Through the Lens of a Native-American Astronomer-Artist" in 9<sup>th</sup> Conference on the Inspiration of Astronomical Phenomena (INSAP IX), Gresham College, London, U.K., in press (2015). Link to publisher can be found here: <http://sophia-project.net/conferences/insapix/publication.html>
- **A. Lee**, Cover artwork, close up – *Maang* constellation, *Journal of Astronomy in Culture* **1**(1), 2016; available at <http://escholarship.org/uc/jac>
- **A. Lee**, "Ojibwe Giizhiig Anung Masinaaigan and D(L)akota Makoče Wicāŋhpi Wowapi: Revitalization of Native American Star Knowledge, A Community Effort," *Journal of Astronomy in Culture* **1**(1), 2016.
- **J. Sinko**, M. Gaffney, R. Preusser, K. Sivaprakasam, T. Tran, and D. Flevaraki, "Diffuse Reflectance Study on Thermochromic Materials for Solar Infrared Switching," Novel Optical Materials and Applications 2016, NoW1D, Vancouver, B.C., 18-20 July 2016, pp. 1-2.
- **T. R. Vaccaro**, R. E. Wilson, W. V. Hamme, and D. Terrell, "The V471 Tauri System: A Multi-Data-Type Probe," *The Astrophysical Journal* **810**:157, 1-28, 2015.; Also available at: [http://repository.stcloudstate.edu/phys\\_facpubs/5](http://repository.stcloudstate.edu/phys_facpubs/5)

## Faculty Grants and Awards, Fall 2015...Summer 2016

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### Submitted Proposals

- **NASA/Astrophysics Data Analysis** Spring 2016 **Prof. Todd Vaccaro** (w/ Geraldine Peters, USC) (...1 M \$)  
"The L/T Phenomenon and Pulsation in Active Close Binary Systems"
- **NASA/Innovative Advanced Concepts** Summer 2016 **Prof. John Sinko** (up to 125,000 \$)  
"Laser Tractor Beam System for Astronaut Rescue"

### Awarded Proposals

- **Center for Applied Atmospheric Research & Education** 2015-16 **Prof. Annette Lee**  
Evaluator Collaboration: San Jose State University, Fond du Lac Tribal & Comm. College, NASA-MIRO-MUREP
- **Manitoba First Nations Educator Resource Center** 2015-16 **Prof. Annette Lee**  
"Native Skywatchers Collaborative Grantwork"
- **NASA Minnesota Space Grant** 2015-16 **Prof. Annette Lee**  
"Native Skywatchers – Research, Course, and Educator Workshop"
- **SCSU Faculty Improvement Grant (Long Term)** Fall 2015 **Prof. John Sinko** 8,000.00 \$  
"Development and Ablatant Analysis of a Laser Electric Thruster"
- **SCSU Faculty Improvement Grant (Short Term)** 2015-16 **Prof. Annette Lee**  
"Communicating Astronomy with Short Dynamic Videos"
- **SCSU University Researcher Grant** Fall 2015 **Prof. John Sinko** 5000.00 \$  
"Propellant Development for Astronaut Retrieval by Laser Tractor Beam"

### Awards and Honors

- **Co-curator, Native Astronomy Exhibit**, Canada Science & Technology Museum, Ottawa, Canada, 2016-present  
**Prof. Annette Lee**
- **Travel Award, XXIXth International Astronomy Union General Assembly** 2015-16 **Prof. Annette Lee**

## Faculty Presentations, Fall 2015...Summer 2016

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- **Annette Lee** 8/2015 "Native Skywatchers: Indigenous Revitalization Efforts," invited talk, Canada Science and Technology Museum, Ottawa, Canada
- **Annette Lee** 8/2015 "The Cosmos as Viewed Through the Lens of a Native-American Astronomer-Artist," Inspiration of Astronomical Phenomena (INSAP) IX Conference, Gresham College, London, England
- **Annette Lee** 8/2015 "Revitalization of Ojibwe & D(L)akota Star Knowledge-Collaboration with Educators," International Astronomical Union (IAU) General Assembly, Division C – Education, Outreach, and Heritage, Honolulu, Hawaii, USA



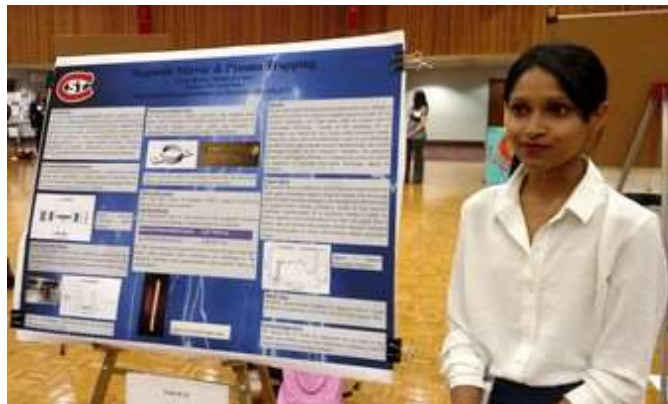
## Student Grants and Awards, Fall 2015...Summer 2016

**SCSU SRC 1<sup>st</sup> Place Poster**  
**SCSU SRC Finalist**

Spring 2016 **Tyler Baxter** "Laser Ablation Material Capture"  
Spring 2016 **Sutapa Biswas** "Testing Non-Linear and Fractional Order Circuit"



Faculty Sponsor: John Sinko



Faculty Sponsor: Gary Bohannon

### FY2016 Student Research Grants

- |  |           |
|--|-----------|
| ○ <b>Sutapa Biswas, Michael Severson</b> (Sponsor: Dr. John Sinko)<br>"Magnetic Mirror & Plasma Trapping"  | 500.00 \$ |
| ○ <b>Chris Crawford</b> (Sponsor: Dr. John Sinko)<br>"Plasma-Enhanced Chemical Vapor Deposition of Diamond-Like Carbon"  | 469.00 \$ |
| ○ <b>Dustin Gilyard</b> (Sponsor: Dr. John Sinko)<br>"Laser Plasma Generation For A Propulsion System"   | 500.00 \$ |
| ○ <b>Dustin Gilyard</b> (Sponsor: Dr. John Sinko)<br>"Pulsed Plasma Thruster"  | 500.00 \$ |
| ○ <b>Seth Hennagir</b> (Sponsor: Russ Lidberg)<br>"Charge Carrier Mobility Determination of Polyacenes by Time-of-Flight"  | 489.00 \$ |
| ○ <b>Seth Hennagir</b> (Sponsors: Russ Lidberg / Dr. Tamara Leenay)<br>"Charge Carrier Mobility Determination of Rubrene Derivatives"                            | 493.00 \$ |
| ○ <b>William Julius</b> (Sponsor: Dr. John Sinko)<br>"High Voltage Modification of Photo-Electric Absorption in Metallic Foils"                                  | 425.00 \$ |
| ○ <b>Jon Lepp</b> (Sponsor: Dr. John Sinko)<br>"Multispectral Diode Laser"   | 500.00 \$ |
| ○ <b>William Muench</b> (Sponsor: Dr. John Sinko)<br>"Fiber Optic Detection of Plasmas within a Vacuum Environment"  | 500.00 \$ |
| ○ <b>Michael Rogers</b> (Sponsor: Russ Lidberg)<br>"Photodynamics of Organic Based Solar Cell Materials Studied by Pumpprobe Transient Absorption Spectrometry"  | 495.00 \$ |
| ○ <b>Michael Rogers</b> (Sponsor: Russ Lidberg)<br>"Photodynamics of Organic Based Solar Cell Materials Studied by Pump-probe Transient Absorption Spectrometry" | 496.00 \$ |
| ○ <b>Grant Schellberg</b> (Sponsor: Dr. John Sinko)<br>"Fresnel Lens Oven"   | 476.00 \$ |
| ○ <b>Tyler Schweisthal, Martin Mutai, Michael Lachner</b> (Sponsor: Dr. John Sinko)<br>"3-D Printed Tracking Telescope"  | 490.00 \$ |
| ○ <b>Rita Schwieters, Travis Hislop</b> (Sponsor: Russ Lidberg)<br>"Four-Wave Mixing for Solid-State Materials"  | 998.00 \$ |
| ○ <b>Rita Schwieters, Travis Hislop</b> (Sponsor: Russ Lidberg)<br>"Four-Wave Mixing System Design for Chemical Sensing"   | 495.00 \$ |



## Outreach Activities, Fall 2015...Summer 2016

### STEM Summit

A free carnival of science for all. The SCSU Physics and Astronomy Club often runs a department table, demonstrating physics and optics 'magic tricks', an interactive 'torque chair', and a pendulum worm.

### Chemistry & Physics Teachers Night

The Dept. of Chemistry & Biochemistry and the Dept. of Physics & Astronomy host a Teachers' Night in the Fall. Professors and local high school teachers meet in the evening to share interesting science demonstrations and activities, and discuss teaching and learning methods. This year, Dr. John Sinko and Dr. Todd Vaccaro gave a presentation on Non-Newtonian fluids.

### Science Rocks

Science Rocks is an activity day where students from local elementary and middle schools come to SCSU to engage in interactive laboratory experiences. Past activities included pendulums, electronics, and lasers. Physics (lasers and the pendulum worm) have dominated the front cover of the Science Rocks magazine for 2 years. Student assistants are needed each year to help the laboratory activities run smoothly.

### Women in STEM ("WE-STEM")

This faculty group seeks to identify and pursue ways SCSU can more proactively support women in science, technology, engineering, and mathematics fields.

### Regional Science & Engineering Fair

Middle and high school students from central Minnesota region present their science projects. Physics students and faculty regularly volunteer as judges to help rank projects in the competition.

### Horizons

The Horizons Conference, hosted by the Society of Women Engineers (SWE), is an activity day geared towards leading middle school girls to remain engaged in STEM and become scientists. A gender gap persists in many science and engineering fields, including physics. Horizons gives young women an engaged experience on campus with female student and professor science mentors. Student participation is vital to give our young colleagues relevant role models.

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### Tech Savvy

Tech Savvy is a new outreach activity just coming to St. Cloud State University that brings in young women for engaged workshops – presented by women - on science & engineering topics. The intention is to provide good role models for young women to keep them in science and engineering fields.

### Pipeline Summer Camps

The Pipeline summer camps include SDP (Scientific Discovery Program) and APTS (Advanced Program in Technology and Science), managed by Dr. Robert Johnson of the Department of Ethnic and Women's Studies. The program brings regional and international high school students from underrepresented minorities to St. Cloud State University to work closely with faculty and student mentors on research projects for a few weeks. The students have a wide range in terms of level of preparation. At the end of the camp, the students present their research progress in a colloquium-style poster session, and assemble a final report.

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## **We Welcome Assistance!**

Supporting students is our number one goal and we owe it to them to provide the resources necessary if we want to continue to be at the forefront of applied research in the state and region. The cost of providing these real-world opportunities continues to rise. With your generosity and support we will be able to recruit and retain our students with scholarship assistance, we will give them enhanced experiences on the most up-to-date technology and instrumentation and we will be able to assist them in guiding and presenting their research through student professional development funds. Please consider helping our students with your gift today!

Name \_\_\_\_\_

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Email address \_\_\_\_\_

\_\_\_\_\_ I would like to support the Physics General Fund

\_\_\_\_\_ I would like to specify a donation for \_\_\_\_\_

Please make check out to St. Cloud State Foundation (or Dept. of Physics & Astronomy, if you prefer)  
720 4<sup>th</sup> Ave. South  
St. Cloud, MN 56301-4498

**THE STUDENTS OF THE PHYSICS & ASTRONOMY  
DEPARTMENT THANK YOU FOR YOUR SUPPORT!**