



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

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**From the Chairperson's Desk...**

In the corporate world people get excited when 'their stock value is up'. We are thrilled to observe our stock valuation is increasing as the enrollments in COSE programs are up, and especially enrollments in courses offered within the Department of Physics and Astronomy. These are exciting times! Let me make just a few remarks to update folks on the happenings within the department.

Maria Womack has accepted a new faculty position and moved to the University of South Florida starting fall 2015 where she will be supporting an emerging graduate program in astronomy. John Harlander has also made an adjustment to his professional configuration becoming an Emeritus faculty at SCSU for the purposes of continuing research advancements with his team of collaborators and continuing research training opportunities for students at SCSU. We want to express deep gratitude to both individuals for their outstanding contributions to this department during their tenures here.

The department undertook a self-study exercise and an external review during last academic year. We are very excited to use the entire experience to help shape a forthcoming strategic plan. The reviewers recognized some outstanding features of our (departmental) enterprise, but also suggested ways in which the department might strive to move forward and support its broader mission more effectively. We expect to submit and then live into our strategic plan very soon.

Lastly, we continue to have an exciting set of service and majors courses available for students across the college and the campus. We are also very enthused about ongoing research and scholarly endeavors within the department and we look forward to another stimulating year of teaching, learning, and generally promoting science! Have a great year everybody! ☺



# The Physics and Astronomy Club

## Officers (2014-2015)

*President*            *Anthony Kunkel*  
*Vice President*    *Alexis Corbett*  
*Secretary*           *Brenda Knauber*  
*Treasurer*          *Rita Schwieters*  
*Publicity*            *Travis Hislop*

## Officers (2015-2016)

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

## Faculty Advisors

2014-2015: Dr. John Sinko and Dr. Zenqiang (John) Liu  
 2015-2016: Dr. Todd Vaccaro and Dr. Zenqiang (John) Liu

## Members

Tyler Baxter, Zane Beltz, Sutapa Biswas, Alexis Corbett, Chris Crawford, Brandy Goertz, Sam Hartman, (Joseph Harter), Travis Hislop, (Scott Jennen), (Brenda Knauber), (Anthony Kunkel), Brian Leyendecker, Jason Poepeke, Richard Preusser, Meredith Rupp, Rita Schwieters, Joseph Sperling, Kristin Sperzel, (Robyn Splittstoesser), James Sweeney, Lucas Winkelman, and Jeff Witthuhn



## Major Activities (Fall 2014 - Summer 2015)

9/10/2014	Main Street (indoors) Student Organization Fair
10/2/2014	Monticello Nuclear Simulation Facility Open House field trip
10/27/2014	Bowling Night with the Chemistry Club
10/31/2014	Rooftop tests: pumpkins vs. gravity
11/20/2014	Purdue 10+ Grad Expo talk (Harter, Knauber, Kunkel, & Schwieters)
12/12/2014	Physics Department end of year Holiday Party at Dr. Sinko's house
12/23/2014	Board game night
1/22/2015	Physics & Astronomy / IEEE clubs talk on High Power Lasers (Dr. Sinko)
2/21/2015	Central Minnesota Regional Science and Engineering Fair
3/21/2015	Horizons Conference for Young Women in Science
4/1/2015	Student Organization Awards
4/2/2015	Movie night
5/11/2015	Science Rocks
5/19/2015	Board game night
6/19/2015	Board game night / ice cream social
6/28/2015	Board game night
8/12/2015	Mississippi River Kayak Trip
8/22/2015	Board game night

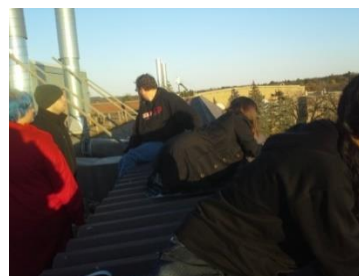


## Upcoming Events

October 2015	Trip to Fermi Lab (over Fall Break)
October 2015	2 <sup>nd</sup> Annual Pumpkin Drop

## Contact

**Join the Physics & Astronomy Club! Contact on Facebook, by email [phy\\_astr@stcloudstate.edu](mailto:phy_astr@stcloudstate.edu), or contact Travis Hislop (the current President): [hitr1201@stcloudstate.edu](mailto:hitr1201@stcloudstate.edu). During the school year, the club meets weekly on the 3<sup>rd</sup> floor of Wick Science Building.**



## Student Recognitions

### Dean's List, Fall 2014

Joseph Lundy  
Meredith Rupp  
Michael Severson

### Dean's List, Spring 2015

Anthony Kunkel  
Rita Schwieters

### 2015 Physics Scholarship

Jack Nieters                  Physics Education 9-12

### Student Research Activities for Credit during the 2014-2015 Academic Year

#### Fall 2014

Tyler Baxter	Prof. Sinko	Hybrid Photon Propulsion Techniques
Intana Chanthirath	Prof. Haglin	Volumetric Techniques for Diatoms
David Corgard	Prof. Bohannan	Non Extensive Entropy
Anthony Kunkel	Prof. Lidberg	Advanced Optical Techniques for Materials Characterization
Rita Schwieters	Prof. Lidberg	Advanced Optical Techniques for Materials Characterization
Chelsea Reinisch	Prof. Lee	Investigations in Yoga Cosmology and Vedic Astronomy Practice

#### Spring 2015

Tyler Baxter	Prof. Sinko	Laser Ablation Material Capture
David Corgard	Prof. Bohannan	Non-Extensive Entropy 2
Clinton Dawson	Prof. Lee	Special Topics in Astronomy (Artificial Gravity on Space Stations)
Christian Fjeldsted	Prof. Lidberg	Statistical Analysis of Charge Transport Properties
Maria Gaffney	Prof. Sinko	Optical Materials Analysis
Seth Hennagir	Prof. Lidberg	Organic Semiconductor Materials
Scott Jennen	Prof. Bohannan	Computational Fractional Calculus
Brenda Knauber	Prof. Bohannan	Mathematical Modeling for Fractional Kinetics
Anthony Kunkel	Prof. Lidberg	Advanced Optical Techniques for Materials Characterization
James Sweeney	Prof. Sinko	Laser Plasma Analysis

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

### Physics & Astronomy Graduates, December 2014

Jonathan Froelich                                  Anthony Kunkel

### Physics & Astronomy Graduates, May 2015

David Corgard	Joseph Harter	Brian Sapp
Maria Gaffney	Scott Jennen	Robyn Splittstoesser
Jeremy Grant	Brenda Knauber	

### Physics & Optics Minors Graduates, 2014-2015

Physics: Christian Fjeldsted and Kristin Sperzel

Optics: Scott Notch

## News and Events, Fall 2014 - Summer 2015

### New Department Website

The new department website has gone live at: <http://www.stcloudstate.edu/physics>  
Department members went through web training from University Communications to gain development access. The new website highlights department strengths such as student engagement and research, and provides quick access to commonly used administrative forms.

### Space Reallocation

Recently, the Department of Physics & Astronomy acquired new spaces in ISELF including the 'Hot Lab' for nuclear physics research and new electronics and optics spaces. This has resulted in the moving of equipment from Wick and Brown Halls into ISELF, but has also seen the surrender of other spaces long held by the department to the nursing and biology departments, including the storage area in Brown Hall 319, and Wick Science Building 7 and 8.



### Optics Table Dispersion

Related to the space reallocation, Prof. Russ Lidberg spearheaded the effort to move the department's optics tables to their new locations on June 19. This is tougher than it sounds, as the 4' x 8' vibration-isolated steel tables usually have masses in excess of 500 kg. Tables are now located in Brown Hall 317 and 318 for the research activities of Prof. Lidberg and Prof. Harlander, and in ISELF 20 and 21 for classes, advanced student projects, and research activities of Prof. Sinko.

### New Equipment

Thanks to the efforts of Prof. Lidberg and Prof. Sinko, the SCSU Physics & Astronomy Department acquired 2 industrial chillers worth nearly \$ 8,000. They will be used to help manage temperature for 'portable' water-cooled laser systems.

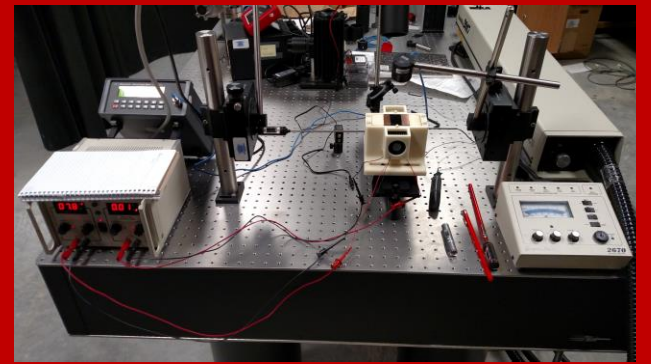
### New Equipment

Prof. Sinko spearheaded an effort to acquire a new roughing pump from Ulvac Kiko worth about \$ 2,000. The pump was purchased with Physics Foundation funds, and arrived in late August. The pump will initially be used to support a PHYS 450 Special Topics: Plasma Physics course in Fall 2015, but will be made portable and moved over to the department for use in the Advanced Lab course and on-demand vacuum needs. The pump uses an ISO KF-25 flange input standard.



### New Equipment

Prof. Sinko, working with Prof. Sivaprakasam in the Dept. of Chemistry & Biochemistry, acquired about \$ 5,500 of new optical sensors and apparatus as part of an internal New Researcher Grant Award on the topic of Smart Coatings for Sustainable Energy.



**News and Events (continued...)**

**Student Research**

Recent graduate Brenda Knauber and Prof. Gary Bohannon (at right) presented their paper on “A Physical Experimental Study of the Fractional Harmonic Oscillator” at the International Symposium on Circuits and Systems (ISCAS ’15) in Lisbon, Portugal in late May. Recently graduated Chemistry student Andrew Skytland helped prepare the fractors; Brenda proved theoretical results and built the circuit.



**Student Research**

A paper by 2<sup>nd</sup>-year student Tyler Baxter and Prof. John Sinko (at right) titled “Assessment of an Interstellar Photon Propulsion Concept” was presented at the 30<sup>th</sup> ISTS/34<sup>th</sup> IEPC/6<sup>th</sup> NSTS Joint Symposium in Kobe, Japan in early July. The research investigated the possibility of operating a solar-sail like, laser-driven spacecraft for interstellar travel.



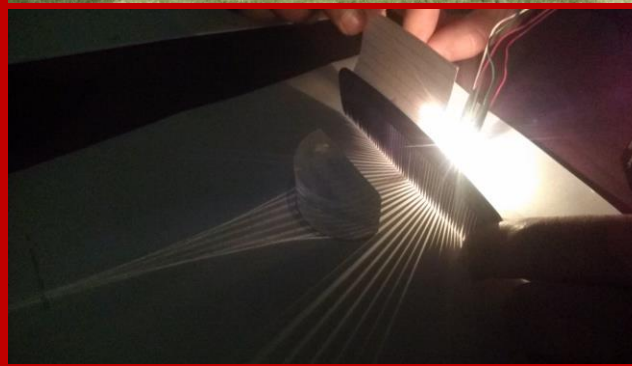
**REU**

From May-August 2015, physics major Rita Schwieters completed an REU (Research Experience for Undergraduates) at Kansas State University, on the subject of solubility of gold nanoparticles. A plan to publish their work is underway.



**AAPT Training Workshop**

In June 2015, Prof. John Sinko participated in the AAPT New Faculty Workshop in College Park, Maryland to practice new teaching & learning techniques.



**Professional Meeting**

In February 2014, Prof. Steve Ratliff attended the midyear topical meeting of the Health Physics Society in Baton Rouge, Louisiana. The theme of the meeting was “Nuclear Power Radiation Safety: Learning from the Past to Protect the Future.”

**SCSU Hosts Minnesota AAPT Meeting**

Prof. Liu organized SCSU’s hosting of the 2015 spring meeting of the Minnesota AAPT in April 2015.



**News and Events (continued...)**

**Geek Girl Panel**

Prof. Polomski was an invited panelist at "Geek Girl Con", a conference in Seattle. GeekGirlCon celebrates and honors the legacy of women contributing to science and technology; comics, arts, and literature; and game play and game design by connecting geeky women world-wide and creating community to foster continued growth of women in geek culture through events.



**Harlow Shapley Award**

Prof. Elisha Polomski received a Shapley award which covered the travel expenses of a guest speaker in the field of astrophysics. The Harlow Shapley Visiting Lectureship Program of the American Astronomical Society is a program of two day visits by professional astronomers who bring the excitement of modern astronomy and astrophysics to colleges of all types. Steve Kawaler from Iowa gave a talk on extrasolar planets and the Kepler Space Telescope.



**AAPT Meeting**

Prof. Liu hosted a 4-hour session ("Open Source Electronics for Laboratory Physics") with 20 attendees at the summer AAPT meeting at the University of Maryland in July 2015.



Traveling to Honolulu, Hawaii, Prof. Annette Lee gave 2 oral presentations at the International Astronomical Union General Assembly in August 2015. One presentation discussed a collaboration of educators for the Native Skywatchers program. The second presentation was with UNESCO, working towards sacred star sites recognition for cultural heritage sites.

In Summer 2015, Prof. Annette Lee attended the Native Skywatchers Educator and Community Workshop, sponsored at Fond du Lac Tribal & Community College, and a second workshop at the Minnesota Department of Education Headquarters in St. Paul

## Faculty, Fall 2014 - Summer 2015

### Prof. and Chair, Kevin Haglin



Prof. and Chair Kevin Haglin earned his B.A. from Hamline University in 1985 and his Ph.D. from the University of Minnesota-Twin Cities in 1990. Recent research projects include calculating the thermal conductivity of subatomic (nuclear) fluid, estimating electromagnetic energy from subatomic furnaces and exploring Virial-theorem features in spiral galaxies. He enjoys supporting his daughters academically and sometimes gets fanatical about their competitive dance activities.

### Prof. John Harlander



Prof. John Harlander was recently awarded a grant for research and development of the Michelson Interferometer for Global High-resolution Thermospheric Imaging (MIGHTI). MIGHTI will be part of an Explorer satellite mission to be launched by NASA in 2017. Prof. Harlander is currently transitioning to Emeritus status to devote time to research.

SCSU News Release, Monday, Apr. 15, 2013, <http://www.stcloudstate.edu/news/newsrelease/default.asp?pubID=3&issueID=34410&storyID=40568&SIimageID=15174>

### Prof. Sneha Kalia



Prof. Sneha Kalia earned her B.S. and M.S. degrees from Delhi University and her Ph.D. from Lucknow University. She teaches all courses from the 100 to 400 level. This year, she attended the American Association of Physics Teachers summer meeting in University of Minnesota-Twin Cities in July 2014. In April, she attended a D2L Brightspace conference in Minneapolis. She has been the advisor to the India Heritage Club for 20 years.

### Prof. Annette Lee



Prof. Annette Lee earned a B.S. from the University of California-Berkeley, a B.A. from the University of Illinois-Urbana, an M.S. in astrophysics from Washington University in St. Louis, and a M.F.A. in painting from Yale. Her physics outreach includes STEM programs focused on serving women and Native American populations. Activities include planetarium shows, SCSU Public Nights, *Native Skywatchers* research and programming initiative, Chemistry and Physics Teachers' Night, Girls Best, Teen/Community Star Party, NASA Sci 4 Girls, ENGAGE, EMARE, the Pipeline summer science camp, astronomy presentations at Oglala Lakota College, and more. Her work will be featured in the Astronomy and Arts show at the Duluth Art Institute. In promoting SCSU physics & astronomy, she authored news articles in the *St. Cloud Times* and in *Central Minnesota Woman*. Her research is supported by SCSU, NASA, the Bush Foundation, Minnesota Space Grant, NSF Northstar STEM Alliance, Minnesota Womens' Foundation, and Fond du Lac Tribal and Community College.

### Prof. John Liu



Prof. John Liu earned his B.S. from Nankai University and his Ph.D. from the University of Minnesota. As an experimental physicist, he works on structures and phase transitions in liquid crystals and conducts collaborative research with UMN and Brookhaven National Laboratory, NY. His expertise is in electronics and computer programming as it relates to experimental physics. He is developing an open source physics laboratory platform to display and log sensors wirelessly for introductory labs. It earned 1<sup>st</sup> place at the 2013 American Association of Physics Teachers Apparatus Competition and also won twice under low cost category.

### Prof. Steve Ratliff



Prof. Steve Ratliff earned his B.S., M.S., and Ph.D. degrees in Physics from the University of California, Los Angeles (UCLA). He also completed a medical physics residency at the Mayo Clinic in Rochester, Minnesota. His current research interests include medical physics, Monte Carlo radiation transport calculations, radiation-induced thermoluminescence, and physics education research. He directs the Nuclear Medicine Technology and Radiologic Technology programs here at SCSU.

### Prof. John Sinko



Prof. John Sinko earned his B.S. in Mathematics and Chemistry at Furman University, and M.S. and Ph.D. in Physics at the University of Alabama in Huntsville, specializing in plasma physics. He previously worked as an Optical Engineer for Kratos Defense & Security Solutions (MSFC/Redstone Arsenal/Huntsville, AL), as a Researcher at The Global Center of Excellence in Micro-Nano Mechatronics (Nagoya, Japan), and as a Visiting Professor at Ohio State University-Newark (Newark, OH). Hobbies include playing the violin, winemaking and martial arts. Contact Prof. Sinko to get involved in research on sustainable energy coatings, optical sensors, or laser propulsion and tractor beams.

### Prof. Maria Womack



Prof. Maria Womack earned her B.S. in physics from Florida State University and Ph.D. in physics from Arizona State University. She has taught a wide variety of astronomy and physics courses at SCSU. She worked with over 60 undergraduate students in research, and was funded by NASA and the NSF, including the CAREER award. During the 2014-2015 academic year, she was on assignment to the NSF Division of Astronomical Sciences, near Washington, DC as the lead program director for the Planetary Astronomy and Stellar Astronomy grant programs. In August 2015, she resigned from SCSU to take a position at the University of South Florida.

## **Fixed Term Faculty (Fall 2014-Summer 2015)**

### Prof. Gary Bohannon



Prof. Gary Bohannon earned his B.S. in Physics at Washington State University-Pullman, his M.S. at the Naval Post Graduate School in Monterey, CA, and his Ph.D. in Physics at Montana State University-Bozeman. His passion is application of the calculus of arbitrary order (fractional calculus) to model dynamical properties of materials. His immediate focus is in developing electronic devices he calls "fractors". He has organized a research group of Physics, Chemistry, and Mathematics students to work together to tackle 300-year old questions in mathematics while potentially creating highly stable, robust control systems.

### Prof. Russ Lidberg



Prof. Russ Lidberg earned his B.S. in Chemistry from University of Nebraska-Omaha, a B.S. in Electrical Engineering from University of Wisconsin-Platteville, a M.S. in Chemistry from University of Nevada-Las Vegas, and is completing his Ph.D. in Chemical Physics at the University of Minnesota-Twin Cities. He manages the Center for Microscopic Imaging and Analysis which houses AFM, SEM and XRD instrumentation. Russ is one of the core developers at SCSU working on developing specialties in material science and nano-materials. He has spent over 30 years in academic and industrial fields of science and engineering, including positions at Lockheed and the U.S. Army Corps of Engineers. His research efforts are centered on the optical and electrical properties of materials, especially organic semiconductors.

### Prof. Elisha Polomski



Prof. Elisha Polomski has a B.A. in Astronomy from Wellesley College in Massachusetts and a Ph.D. in Astronomy from the University of Florida. Elisha has been enjoying her first year at St. Cloud State University and has been involved in several public outreach events. Her interests are diverse, including studying the dust from dying stars and in star formation regions as well as science education, particularly teaching methods which encourage women and minorities to enter STEM fields.

### Prof. Todd Vaccaro



Prof. Vaccaro holds a B.S. in Physics/Astronomy from Vanderbilt University, an M.S. in Astronomy from San Diego State University, and a Ph.D. in Astronomy from the University of Florida. He was previously an Assistant Professor of Physics at Francis Marion University, and also held postdocs at LSU, UF, and FL Tech – all involving astronomy research on stellar photometry and spectroscopy. Prof. Vaccaro now researches eclipsing binary stars, including observation and analysis of red dwarf binaries. Prof. Vaccaro consults for a NASA project dealing with Kepler satellite data. He frequently observes at Kitt Peak National Observatory using the large 4m telescope, and will again in September 2015.



## Adjunct Faculty (Fall 2014)

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### Prof. Dave Williams



Prof. Dave Williams earned his B.S. at the University of Minnesota, and his M.S. at the University of North Dakota. He recently organized a local group of St. Cloud observers to start the Astronomy Club of Central Minnesota. Assistant Professors Gary Bohannon and Todd Vacarro are participating, and Assistant Professor Annette Lee is collaborating with the group. Prof. Williams also writes a monthly column on Astronomy that is published in the St. Cloud Times.

(Photo courtesy of St. Cloud Times)

## Staff (Fall 2014)

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### Ann Hudson



Ann Hudson is the Office Manager for the physics unit. She earned her B.E.S. degree in elective studies from SCSU, specializing in college counseling and student development. She was formerly an HR director in the healthcare industry. She is married to SCSU professor of finance Bill Hudson, has two children (Peter and Emily), and loves traveling and watching her kids play hockey.

### Steve Zinsli



A graduate of SCSU with a B.S. in physics, Steve Zinsli is the ever-present backbone of the physics department's lab activities. He manages the lab supply room, and handles setup and takedown of student laboratories for the introductory classes. He works part-time in Physics and part-time as a technician in the Electrical Engineering Department. He is the local armchair expert on all matters involving the Mississippi River, and is an experienced canoer.

### Kim Gregory



Kim Gregory has been the Interim Office Manager for the Physics & Astronomy unit during the last two summers. She earned her A.A. degree in accounting from St. Cloud Technical and Community College, and is currently working on her bachelor's degree at SCSU in general management. She was previously employed at Benton County Human Services in the accounting department until her position was cut after 10 years, it was then that she enrolled in college. She has three adult sons (Justin, TJ, and Mitch), and enjoys fishing, camping, hunting, 4-wheeling, and cooking.

## Faculty News



Prof. Maria Womack resigned from the SCSU Physics & Astronomy department in August 2015 after 18 years. For the past four years, she worked with the National Science Foundation as an astronomy program director. Previously, Maria taught physics and astronomy courses, conducted astrophysics research at SCSU and was the SCSU Observatory director. She moved with her family to Tampa, Florida, where she started a physics faculty position at the University of South Florida. Her husband, David Rabson, recently became the new chair of the USF physics department, and her daughter, Juliana Pinnick, just started high school. Maria looks forward to returning to comet and exoplanet research, and to including graduate students in her research. She would like to get updates from everyone via [womack@usf.edu](mailto:womack@usf.edu).

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.



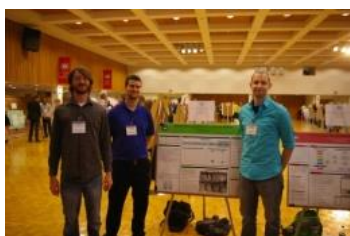
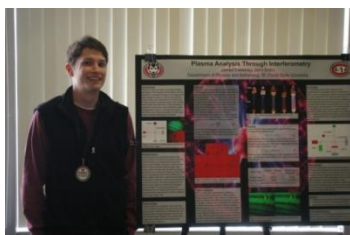
Prof. David Williams is retiring. In his time at SCSU, Prof. Williams served as Planetarium Director for five years before returning from a temporary retirement to teach introductory astronomy courses for six years. Prof. Williams enjoyed creating planetarium shows and excited the public on many different aspects of astronomy. He especially enjoyed teaching the astronomy courses, in which he challenged students to think outside their existence on the third rock from a small star, and gave them cause to ponder the size of the universe. After leaving SCSU, he will continue leading the Astronomy Club of Central Minnesota.

## Department Publications

- **G. Bohannon** and **B. Knauber**, “A Physical Experimental Study of the Fractional Harmonic Oscillator”, presented in the 2015 IEEE International Symposium on Circuits and Systems, Lisbon, Portugal, May 2015, C3L-B04-2608 (2015), pp. 2341-2344. DOI: 10.1109/ISCAS.2015.7169153
- **Pundsack, T.J.**, Haugen, N.O., Johnstone, L.R., Frisbie, C.D. and **Lidberg, R.L.**, “Temperature Dependent c-Axis Hole Mobilities in Rubrene Single Crystals Determined by Time-of-Flight”, *Applied Physics Letters* **106**(11), 113301 (2015). DOI: 10.1063/1.4914975
- C. C. Huang, S. Wang, L. Pan, **Z. Q. Liu**, B. K. McCoy, Y. Sasaki, K. Ema, P. Barois, & R. Pindak, “Liquid Crystal Mesophases beyond Commensurate Four-Layer Periodicity”, *Liquid Crystal Reviews* 3(1), 58-78 (2015). DOI: 10.1080/21680396.2015.1030462
- **Steven Ratliff**, **Kevin Haglin**, Ken Miller, and Mark Petzold, “Course Development for Nuclear Engineering Minor,” presented at Teaching and Learning Fair, St. Cloud State University (August 21, 2014).
- **J. E. Sinko** and **T. R. Baxter**, “Assessment of an Interstellar Photon Propulsion Concept” in Proceedings of the Joint Conference: 30<sup>th</sup> International Space Transportation Symposium, 34<sup>th</sup> International Electric Propulsion Conference, and 6<sup>th</sup> Nano-Satellite Symposium, Kobe-Hyogo, Japan, July 4-10, 2015, IEPC-2015-144/ISTS-2015-b-144, pp. 1-8 (2015).  
<http://archive.ists.or.jp/> or <http://erps.spacegrant.org/index.php?page=iepc-download-88-07>
- **T. R. Vaccaro**, R. E. Wilson, W. Van Hamme, and D. Terrell, “The V471 Tauri System: A Multi-datatype Probe”, ARXIV: 1506.05067 (6/2015), and to be published in *The Astrophysical Journal* (IOP Publishing).  
<http://adsabs.harvard.edu/abs/2015arXiv150605067V>

## Department Grants and Awards

• <b>New Researcher Grant</b>	Fall 2014	Prof. Kannan Sivaprakasam and <b>Prof. John Sinko</b>	7999.80 \$
• <b>AAS Shapley Award</b>	Fall 2014	<b>Prof. Elisha Polomski</b>	Speaker fees
• <b>Vernier Equipment Gift</b>	Fall 2014	<b>Prof. John (Zenqiang) Liu</b>	≈2,000.00 \$
• <b>Student Research Grant</b>	Fall 2014	<b>Anthony Kunkel</b> , and <b>Rita Schwieters</b>	445.00 \$
• <b>Student Research Grant</b>	Spring 2015	<b>Maria Gaffney</b>	680.00 \$
• <b>Student Research Grant</b>	Spring 2015	<b>James Sweeney</b>	713.00 \$
• <b>Student Research Grant</b>	Spring 2015	<b>David Corgard</b> , <b>Bill Muench</b> , and <b>Scott Notch</b>	542.00 \$
• <b>Student Research Grant</b>	Spring 2015	<b>Joe Harter</b> , <b>Anthony Kunkel</b> , and <b>Rita Schwieters</b>	315.00 \$
• <b>SRC Poster Runner-up</b>	Spring 2015	<b>James Sweeney</b>	
• <b>Best Education Org.</b>	Spring 2015	<b>Physics &amp; Astronomy Club</b>	



## STEM Service Opportunities

The Physics & Astronomy Department is active in promoting and supporting STEM (science, technology, engineering and math) service activities. Below is a brief glimpse of activities conducted in the 2014-15 year. Get involved!

### Chemistry and 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 new teaching and learning methods. This year, Prof. Sinko and Vaccaro made a presentation about Non-Newtonian fluids.

### Horizons



The Horizons Conference, hosted by the Society of Women Engineers, is an activity day geared towards leading middle school girls to become scientists. A gender gap persists in most science 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.



### 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.

### Regional Science and Engineering Fair



Middle and high school students in the St. Cloud area present and receive feedback on their science projects. Physics students regularly volunteer as judges to help rank science projects in the competition.

### Senior to Sophomore Program



Many Physics & Astronomy faculty participate in the Senior to Sophomore ('S2S') program, in which high school students earn college credit at SCSU. Professors work closely with teachers such as Jeannie Chu of Monticello High School (above) to deliver engaging, college-level content to high school students.

### STEM Summit

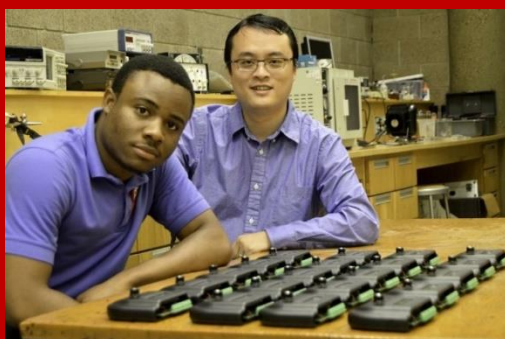
A free-for-all carnival of science, the Physics and Astronomy Club helps with the department's table, demonstrating physics magic tricks, an interactive 'torque chair', and a pendulum worm.

## Physics Research Opportunities

### Dr. John (Zengqiang) Liu

#### Electronics

Dr. Liu studies condensed matter physics (x-ray and laser probes of liquid crystals). He is also developing award-winning open-source laboratory apparatus for physics education.



### Dr. Gary Bohannon

#### Fractional Calculus, Electronics

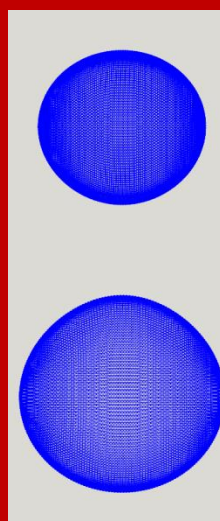
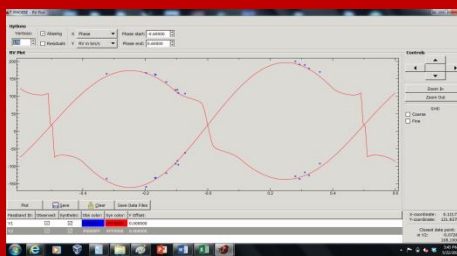
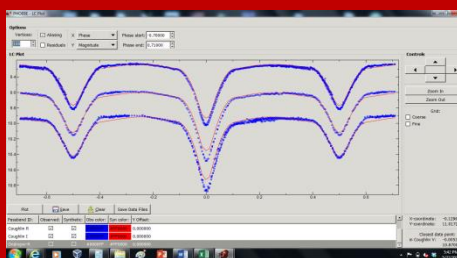
Dr. Bohannon studies 'anomalous' fractional order kinetics in solids (described by power laws rather than exponentials). The experimental research goal is creating materials with both conduction and charge storage properties; *i.e.*, with 'pure' power-law impedance spectra. Such materials exhibit a memory effect useful in signal processing and control system applications. Theoretical research involves the mathematics of fractional calculus and development of efficient computational techniques to analyze fractional kinetics.

As a result of presenting at the Lisbon ISCAS '15 conference, Prof. Bohannon has been asked to develop a research plan for a circuit to be designed at the University of Patras, Greece and tested at the University of California-Merced in collaboration with the India Institute of Technology, Kharagpur, India.

### Dr. Todd Vaccaro

#### Astronomy and Astrophysics

Dr. Vaccaro's main field of research is eclipsing binary stars. He is also leading the 'Radio Jove' project at SCSU, which uses portable, ground-based antennas to intercept radio frequency electromagnetic waves from Jupiter.



### Dr. Kevin Haglin

#### Theoretical/Computational Physics

Prof. Haglin welcomes students to explore various theoretical topics with him.

Recently, several students collaborated with him on a computational ballistics project to determine the effects of drag and inclination angle on projectiles.

Another student recently researched quantum mechanical to compute bound states of delta functions inside wells in 1, 2, and 3 dimensions.

### Russ Lidberg

#### Spectroscopy, Molecular Electronic and Optical Materials and Devices

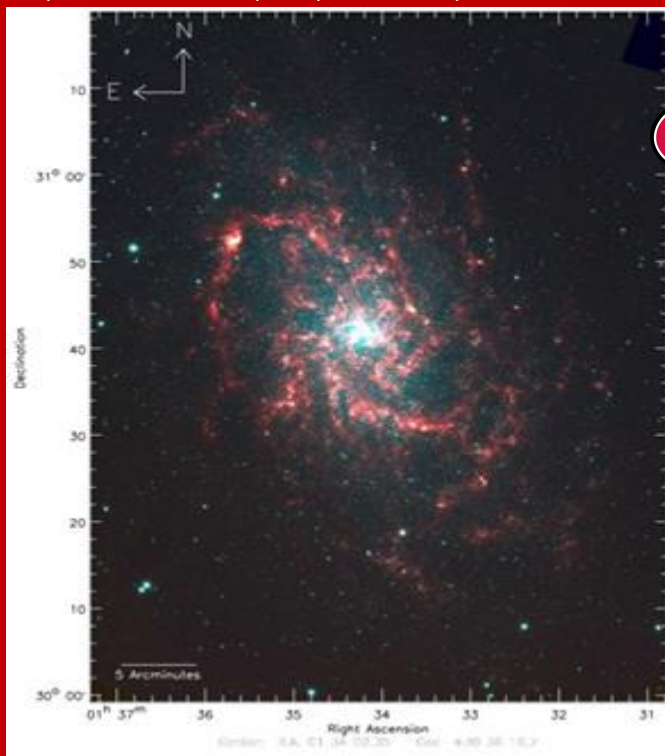
Russ Lidberg's research interests focus on understanding the optical and electrical properties of organic semiconductor materials. The relationship between the molecular structure, solid-state molecular packing and the effect on charge carrier transport and energy transfer is fundamental in the design of electronic and electro optic devices such as organic solar cells, light emitting diodes, transistors and sensors. Laser based spectroscopic and electrical techniques are employed in the study of single crystals, thin films and material interfaces. Surface structure and reactivity can play a major role in device performance. Atomic force microscopy (AFM) is used to study the surface. Projects combine physics, chemistry, materials science and electrical engineering to provide students with a real world interdisciplinary research environment.

# Physics Research Opportunities

## Dr. Elisha Polomski Astrophysics

Elisha Polomski's research area is astrophysical dust and infrared radiation from young stars, planet formation regions and dying stars. Elisha has been involved in the Spitzer Space Telescope mission as a guest observer and was the observation planner for the entire University of Minnesota Spitzer program. The image below is a long wavelength infrared image of the M33 galaxy taken as part of the University of Minnesota Spitzer program.

Elisha is also involved in public outreach and was twice awarded an American Astronomical Society Shapley grant which funds a astrophysics guest speaker. This Spring, Elisha hosted Dr. Steve Kawaler from the Iowa State University who discussed results from the search for exoplanets with the Kepler Space Telescope.



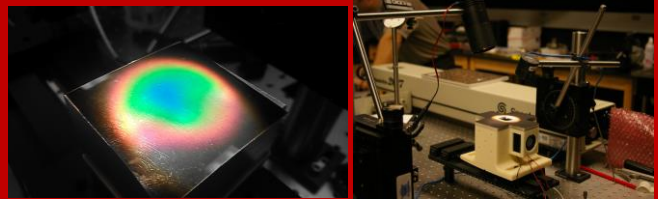
## Dr. Steve Ratliff Medical Physics

Past SCSU student research projects have included projects in radiation-induced thermo-luminescence, retrospective dosimetry, radiation measurements, and radiation transport calculations. Please contact Dr. Ratliff for more information if you are interested in doing research with him.

## Dr. Sinko Laser Propulsion, Sustainable Energy, Sensors

Prof. Sinko is currently in great need of students interested in joining one of three projects:

### 1. Sustainable Energy Coatings



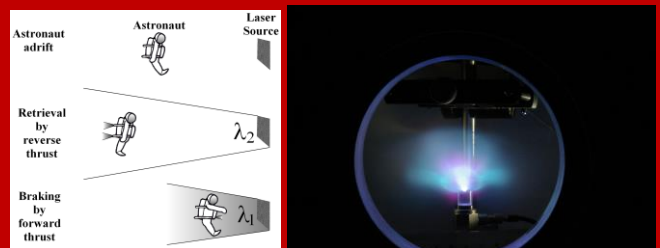
This interdisciplinary project with the Chemistry Dept. (funded to ~8000\$) seeks to create a smart material coating to offset residential heating and cooling costs. It involves electronics, optics, and mechanical engineering research.

### 2. Laser Interferometric Sensors



This project is trying to develop a new sensor to measure pressure under vacuum and detect chemicals in air. It involves optics and potentially computer science.

### 3. Laser Ablation / Electric Propulsion



This project's focus is developing plasma diagnostics and novel thrusters. Possible projects include laser tractor beams to retrieve incapacitated astronauts, laser-electric thrusters, and high-power laser ablation of materials.

**Contact Dr. Sinko to get involved!**

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## We Welcome Assistance!

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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!

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Please make check out to St. Cloud State Foundation (or Department of Physics & Astronomy if you prefer)  
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St. Cloud, MN 56301-4498

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