

Physics & Astronomy Department Newsletter

Vol. 6, No. 1 (Fall 2018-Summer 2019)



ST. CLOUD STATE
UNIVERSITY

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

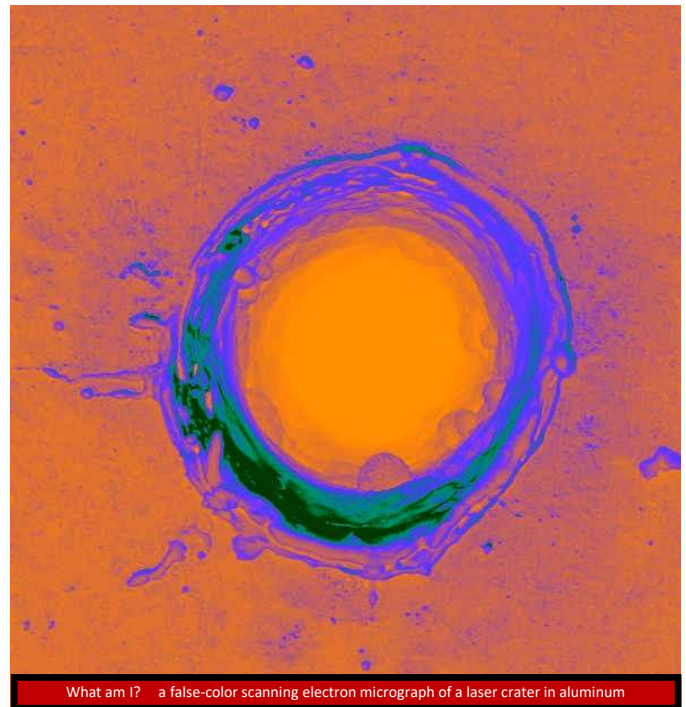
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Editor: Dr. John E. Sinko

Send news to jesinko@stcloudstate.edu

or

Physics Department Newsletter
309 Wick Science Building, SCSU
720 4th Ave. South, St. Cloud, MN 56301



St. Cloud State University Physics faculty: Rear row, left to right: Dr. Chris Kvaal, Steve Zinsli, Dr. John Sinko, Dr. Christofer Nelson, Dr. Kevin Haglin
Front row, left to right: Dr. Sneh Kalia, Dr. Steve Ratliff, Dr. Zengqiang "John" Liu, and Dr. Todd Vaccaro. Absent from photo: Dr. Ka-Wah Wong

Physics & Astronomy Facilities Updates (2018-2019)

Quantum Computing

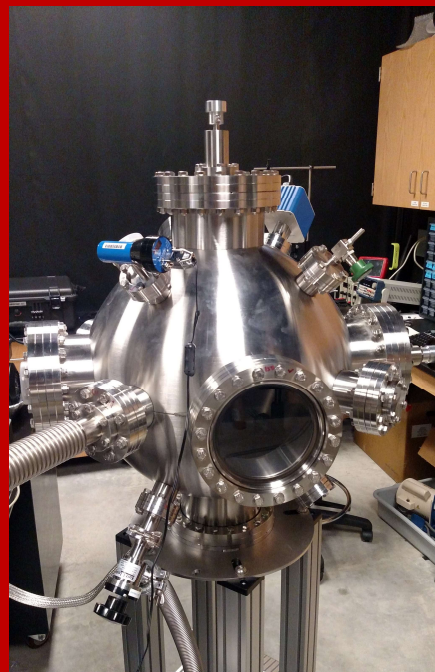
WSB 340

In Fall 2018, Dr Liu began setting up a new quantum optics laboratory to attempt to study interactions of single photons. Any students interested in this topic are encouraged to contact Dr. Liu. This research also directly relates to the PHYS 328 Modern Physics and PHYS 431 Quantum Mechanics courses.



18" Vacuum Chamber Goes Live ISELF 21

Dr. Sinko brought an 18" chamber to high vacuum (10 nano-atmospheres) to enable laser propulsion research and other space-related experiments.



Computational Laboratory

WSB 343

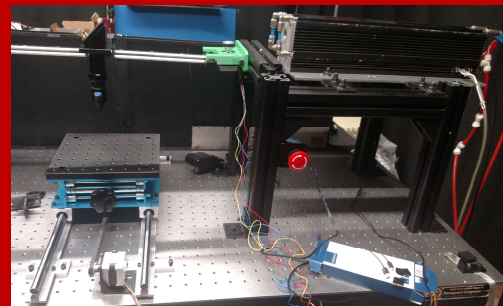
Dr. Haglin has been setting up a computational physics lab for student research to support future classes. Students interested in computational physics should contact Dr. Haglin.



CNC Laser Space

ISELF 20

A senior design team guided by Dr. Jay Byun in Mechanical Engineering built an operational CO₂ laser 2D marking system. The laser was donated from Bernie Koch at 3M.



Physics & Astronomy Club News

MainStreet

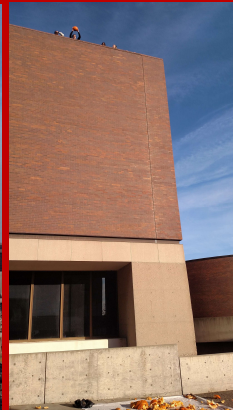
Physics majors and faculty worked to recruit new club members for the 2018-2019 year during the SCSU MainStreet event. Chase Negen brought along some bismuth (below) in a crucible, which Dr. Sinko brought to the melting point (271.4°C) using a Fresnel lens (right), caught on the department FLIR camera (far right, bottom). Below, Matt Thomas staffs the table.



Halloween Pumpkin Drop!

The Physics & Astronomy Club's annual inspection of Terrestrial gravitation commenced October 31st, 2018 from a location of superior potential energy atop Wick Science Building. According to a reliable source who was present for the test but wishes to remain anonymous, gravitational acceleration is still operational at approximately 9.8 m/s^2 .

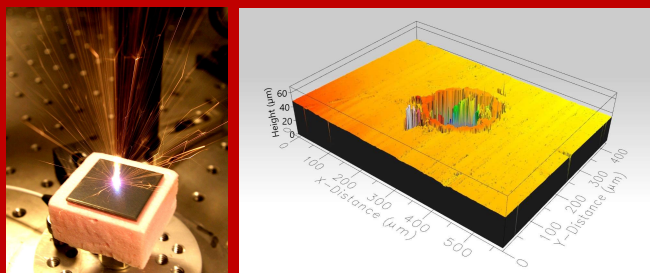
Below left: gravity inspectors preparing for test; below middle: pumpkin acceleration under 1.000 g load; below right: gravity test data



Community Engagement and Active Learning

Tech Savvy

This event seeks to recruit young women into STEM fields. For Fall 2018, participants used a pulsed Nd:YAG laser to create miniature craters (and in a few cases, holes) in aluminum and steel targets. The students analyzed the craters using instrumentation in ISELF including optical microscopy and white light optical profilometry.



Science Rocks

This event seeks to recruit young people into STEM fields. Dr. Sinko led several groups of participants in learning about optics, light, and lasers. The groups then donned safety goggles and moved to the laser lab to ablate tiny craters and holes in thin aluminum and steel plates using the NdYAG laser system in ISELF 21.

One of the young women was quite enthused about vaporizing metal but expressed significant disappointment when the entire 25mm sample did not spontaneously vanish under the laser beam.

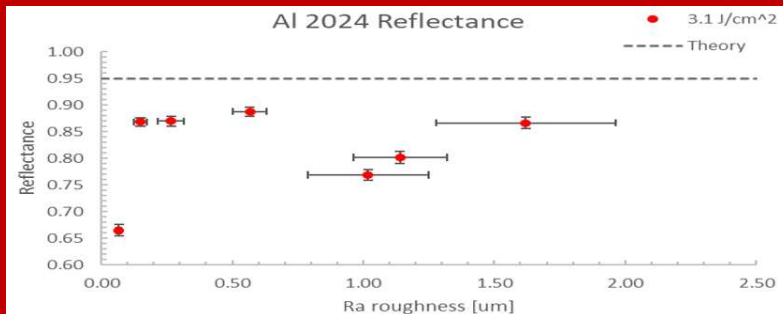


2/2019 Regional Science Fair

This event evaluates middle and high school student science project presentations in a “poster session” format. Dr. Kevin Haglin participated as the International Fair Director, managing special awards and providing award decisions to move exceptional projects forward to the International Science Fair. Physics faculty Dr. Christofer Nelson and Dr. John Sinko also participated in the event as regular table judges, providing feedback on presentations.

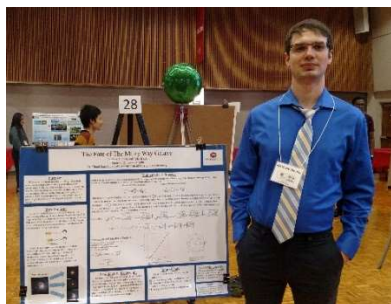
‘Advanced Program in Technology and Science’ Summer Camp

This program engages international and underrepresented high school students in summer STEM research. For 2019, Chicagoan Yaritza Roman joined Dr. Sinko’s laser space debris project with mentoring from Chase Negen. Yaritza tested heating of aluminum targets by laser to ascertain the limits of laser ablation of aluminum space debris. She discovered anomalously low reflection during laser irradiation of the aluminum samples, and prepared a poster and report on her work.



Physics & Astronomy in the 2019 Student Research Colloquium

Matthew Thomas presents a poster he created with Tyler Baxter of their research work with Dr. Haglin on the fate of the Milky Way galaxy.



Shawn Kamphuis, Justin Hauswirth, and Joel Vincent present their senior design project under Dr. Serdar Sezen. They built a translation stage to operate inside Dr. Sinko's 18" scientific vacuum chamber.

SCSU Student Research Colloquium, 4/23/2019

DEMONSTRATIONS

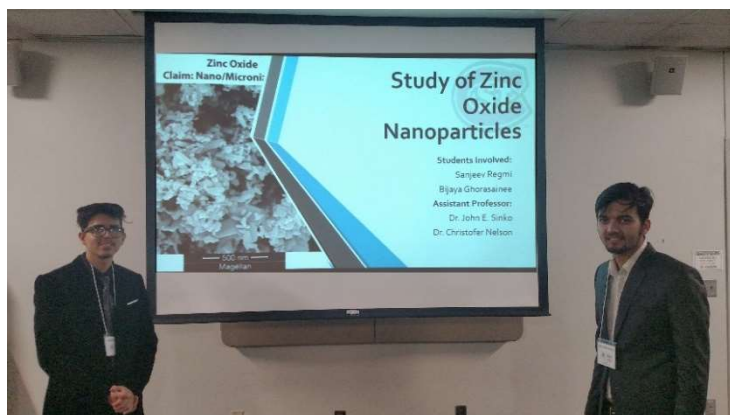
Student	Faculty Sponsor(s)	Title of Project
Anne Chase	William Gorcica, Zengqiang "John" Liu	"Gather"

ORAL PRESENTATIONS

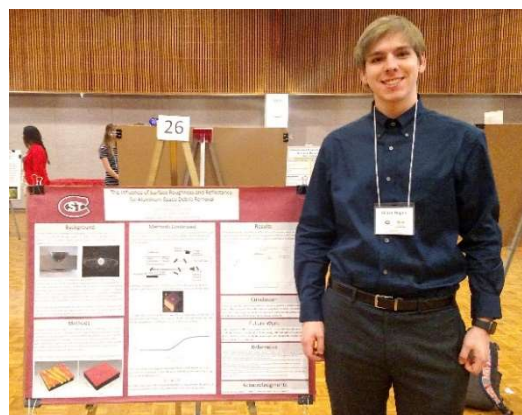
Student	Faculty Sponsor(s)	Title of Project
Christopher Anderson, Shawn Anderson, Raaed Bamadhan, Peter Palacek	Jeongmin Byun, John Sinko	"Three-Dimensional Laser Positioning System"
Bijaya Ghorasainee, Sanjeev Regmi	John Sinko	"Study of Zinc Oxide Nanoparticles"
Joel Vincent, Shawn Kamphuis, Justin Hauswirth	Serdar Sezen, John Sinko	"Vacuum Chamber Lens Positioning System"

POSTERS

Student	Faculty Sponsor(s)	Title of Project
Jordan Kleinschmidt	John Sinko	"CNC Wood Engraving Table"
Chase Negen	John Sinko	"The Influence of Surface Roughness and Reflectance for Aluminum Space Debris Removal"
Matthew Thomas (with Tyler Baxter)	Kevin Haglin	"The Fate of the Milky Way Galaxy"



Sanjeev Regmi (left) and Bijaya Ghorasainee (right) present their zinc oxide nanoparticle research



Chase Negen presents his work on heat accumulation during laser irradiation of aluminum

Physics & Astronomy Student Awards, Fa 2018-Sp 2019

St. Cloud State University – College of Science & Engineering – Dean's List

SCSU COSE Dean's List Fall 2018

Joselyn Christopherson
Kelly McElvain
Michael Free

SCSU COSE Dean's List Spring 2019

Michael Free
Edison King
Hyun Seo

Physics Department Scholarships

2018-2019 Academic Year

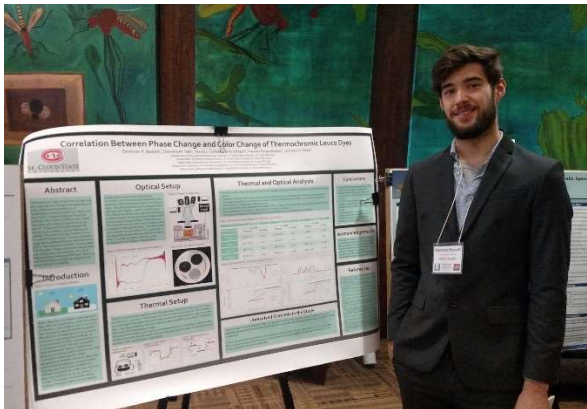
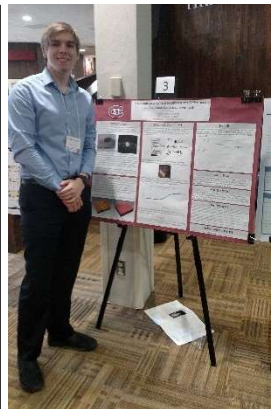
Chase Negen
Tanner Maehren

Additional Student Highlights

- Physics major **Chase Negen** and undergraduate student **Donovan Bassett** presented at the Minnesota Undergraduate Scholars Conference in St. Cloud, MN.

8th Annual Minnesota State Conference of Undergraduate Scholarly and Creative Activity:
3/25/2019

Physics major Chase Negen presents a poster on his research with Dr. Sinko into reflectance and heat accumulation in experiments on aluminum space debris removal.



8th Annual Minnesota State Conference of Undergraduate Scholarly and Creative Activity:
3/25/2019

Donovan Bassett presents a poster on research work with Dr. Sinko and Dr. Sivaprakasam (Dept. of Chemistry) measuring phase changes in thermochromic dyes.

- Chase Negen** is a coauthor on a paper presented in the June 2019 AIAA Aviation Forum (Dallas, Texas)
- Aquib Al Ahmed Immanuel** and **Anna Stevens** were awarded Learning Assistant positions and assisted Dr. Sinko in Physics 234: Classical Physics I in Spring 2019.
- Aquib Al Ahmed Immanuel** served as a camp counselor for APTS
- Chase Negen** served as research assistant mentor for APTS
- Chase Negen, Elatia Zaffke, Bijaya Ghorasainee, Binit Sthapit, and Sameer Khadka** served as research assistant mentors in Dr. Sinko's group for Education USA Academy

Physics & Astronomy Student Research Awards, Fa 2018-Sp 2019

Fall 2018 Student Research Awards

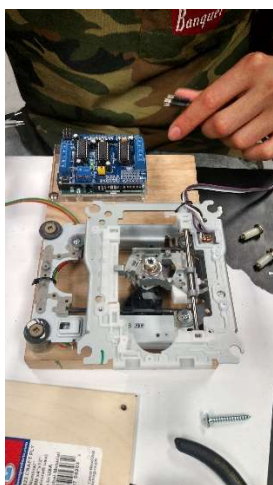
➤ Travis Ahlgren	Faculty Sponsor: John Sinko	\$ 400
➤ “Schlieren Imaging with Space Debris Clearing Laser”		
➤ Chase Negen	Faculty Sponsor: John Sinko	\$ 876.99
➤ “Laser Based Removal of Space Debris”		
➤ Joel Vincent	Faculty Sponsors: Ahmet Sezen, John Sinko	\$ 805.18
➤ “High Vacuum Positioning System”		

Spring 2019 Student Research Awards

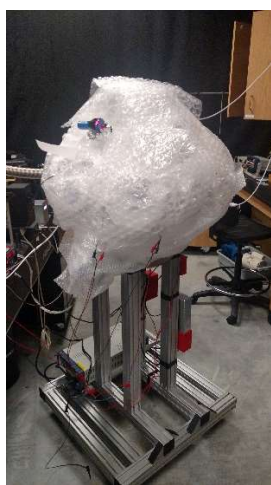
➤ Andrew Fobbe	Faculty Sponsor: John Sinko	\$ 959.20
➤ “Achievement of High Vacuum Space Pressures to enable Laser Experiments”		
➤ Jordan Kleinschmidt	Faculty Sponsor: John Sinko	\$ 290.68
➤ “CNC Wood Engraving Table”		
➤ Sanjeev Regmi, Bijaya Ghorasainee	Faculty Sponsor: John Sinko	\$ 403
➤ “Study of Zinc Oxide Nano Particles”		

Summer 2019 Student Undergraduate Research Fellowships (\$2000 summer research stipend, +supplies budget if requested)

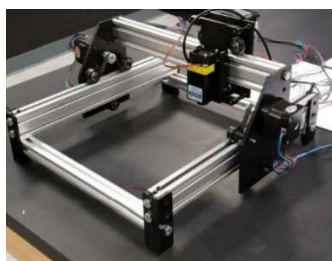
➤ Aquib Al Ahmed Immanuel	Faculty Sponsor: John Sinko	\$ 198.18
➤ “Laser Ablation of Aluminum by Varying Pulse Duration”		
➤ Bijaya Ghorasainee	Faculty Sponsor: John Sinko	N/A
➤ “Laser Production and Characterization of Zinc Oxide Nanoparticles using Immersed Vaporization of Zinc”		



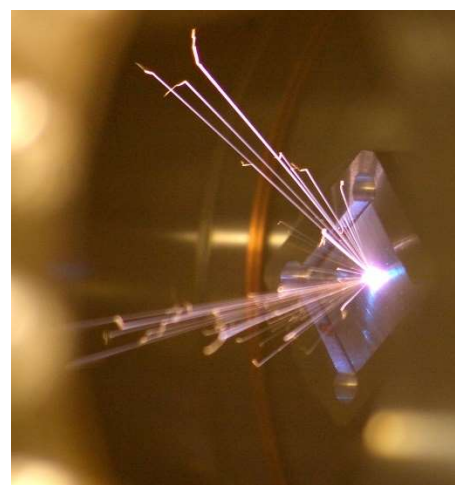
Bijaya Ghorasainee builds a 2D stage for ZnO nanoparticle production with student grant-funded supplies.



Andrew Fobbe's grant purchased heating tapes and a variac to enable chamber bakeout to reach high vacuum.



Jordan Kleinschmidt used student grant funds to create an inexpensive 2D stage for machining and marking using a high-power blue diode laser.

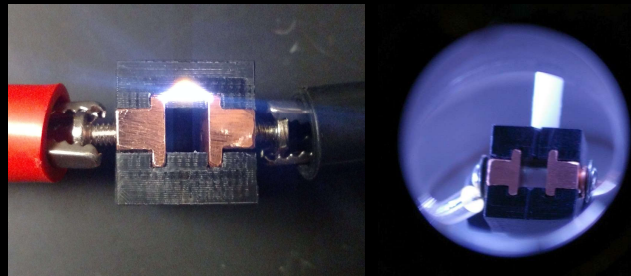


Chase Negen used grant funds to test heat accumulation during laser irradiation and ablation of aluminum, as a function of laser intensity, surface roughness, and the type of aerospace aluminum alloy used.

Student Research in Physics & Astronomy 2018-2019

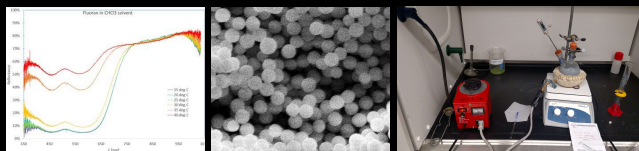
Pulsed Plasma Thruster Development

Physics student Matthew Thomas built and studied a pulsed plasma thruster using residual gas analysis.



Analyzing Color Changing Solar Materials

This established research project studies temperature rise in color-changing organic leuco dye materials under simulated solar illumination. Dr. Sinko needs a student with chemistry and optics background to continue this research.



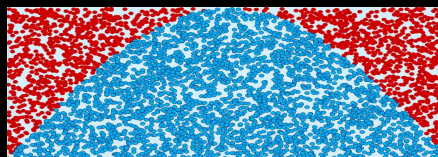
RF for Supernova Shock Waves

This year, physics major Elatia Zaffke worked with Dr. Sinko to set up a vacuum chamber and plasma to simulate supernova shock waves in a stellar nebula.



Generating Random Numbers

True random numbers are hard to generate for applications like encryption. One option is use of a random process like nuclear decay. SCSU student Nicholas Hiltner worked with Dr. Liu to improve on the random number generator seeded by radiation counts, using an Arduino Uno and Raspberry Pi 3+.



Radiation Physics and Medical Physics

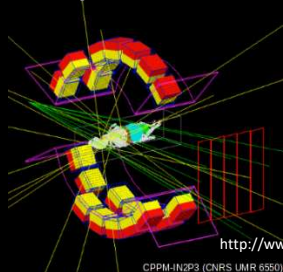
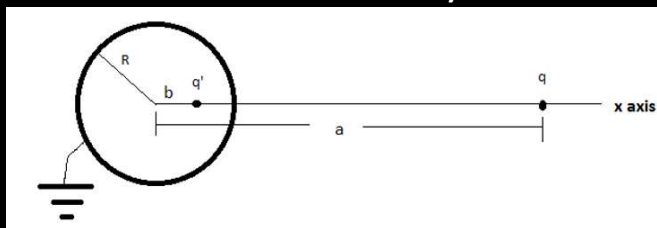


Image source:
<http://www.opengatecollaboration.org/>
GPPM-IN2P3 (CNRS UMR 6550)

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

Theoretical Particle Physics

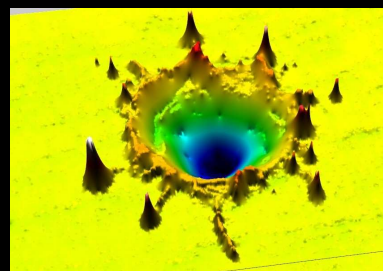
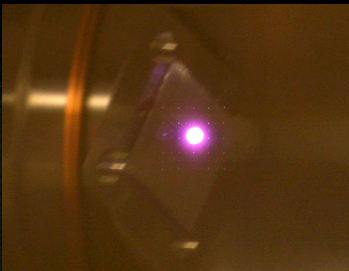


Physics student Sam Hartman worked with Dr. Haglin to study a point charge near a grounded spherical superconductor in both relativistic and non-relativistic frames, uncovering unexpected behavior. If you are interested in theoretical physics research or in learning more about particles, please contact Dr. Haglin!

Student Research in Physics & Astronomy 2018-2019 (2/2)

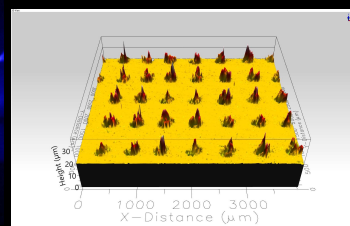
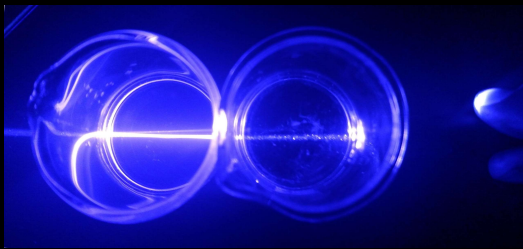
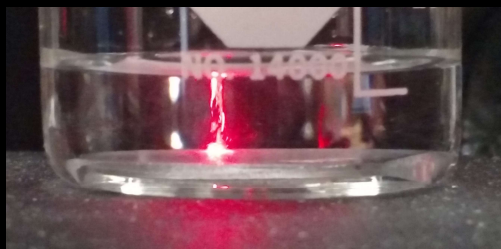
Space Debris Elimination

Space debris accumulation in orbit threatens our continued use of satellites. Physics students Chase Negen and Andrew Fobbe studied laser ablation of aluminum in the laboratory using scanning electron microscopy, optical microscopy, white light optical profilometry, thermistor-based temperature measurements, piezoelectric force sensors. Tests in both air and vacuum were conducted, and a variety of aluminum alloys and prepared surface roughness were tested. The research was presented at a national AIAA meeting in Dallas, Texas in summer 2019.



Laser Formation of Zinc Oxide Nanoparticles

Mechanical Engineering majors Bijaya Ghorsainee and Sanjeev Regmi worked with Dr. Sinko, Dr. Nelson, and Dr. Petitto in the Chemistry Department to produce, refine, and analyze zinc oxide nanoparticles by underwater laser ablation of zinc. The students built a 2D micro-stage to allow precise, bulk laser ablative processing of the zinc targets, and checked the ablation using white light profilometry. They began analyzing their size distribution and composition using Dynamic Light Scattering and scanning electron microscopy with energy dispersive spectroscopy.



Physics & Astronomy Faculty 2018-2019

Dr. Kevin Haglin

Professor, Physics



Theoretical Physics

Dr. Sneh Kalia

Professor, Physics



Physics

Dr. Chris Kvaal

Professor, Biology
Department Chair



Molecular Biology, Genetics

Prof. Annette Lee

Associate Professor, Astronomy
SCSU Planetarium Director



Astronomy

Dr. Zengqiang (John) Liu

Associate Professor, Physics



Experimental Physics

Dr. Christofer Nelson

Assistant Professor, Physics



Structural Glass, Theoretical Materials

Dr. Steven Ratliff

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



Medical Physics, Radiation Transport

Dr. John Sinko

Assistant Professor, Physics
SCSU Laser Safety Officer



Experimental Physics, Optics, Materials

Dr. Todd Vaccaro

Adjunct Professor, Physics



Astrophysics, Astronomy

Dr. Ka-Wah Wong

Assistant Professor, Physics

(no image provided)

Astrophysics, Astronomy

Physics & Astronomy Faculty and Staff News 2018-2019

Dr. Sinko completed his fifth year as a probationary (tenure-track) Assistant Professor, and submitted a successful application for tenure and promotion. He will return to the department as an Associate Professor for the 2019-2020 academic year.

Dr. Chris Nelson's position with the department was renewed for another year. Dr. Nelson served the fourth year of his fixed term position in AY 2018-2019.

Dr. Kah-Wah Wong joined the department in Fall 2018 as Fixed-Term Non-Probationary faculty for the 2018-2019 academic year. Dr. Wong, an expert in x-ray astronomy and astrophysics, came to us from Minnesota State University – Mankato. He departed in Spring 2019.

Dr. Todd Vaccaro served as an adjunct professor in the 2018-2019 academic year. He successfully applied for a position at Ball State University in Muncie, Indiana, and will begin work there beginning Fall 2019.



A heartfelt welcome to our new department Office Administrative Specialist, Denise Schaefer, who began working with the department in Spring 2019.

Kari Kinney, our former Office Administrative Specialist, left the department in Spring 2019. Thank you Kari for your dedicated service to the department!



Ann Hudson, our longtime departmental Office Administrative Specialist, retired from the department in November 2018. Thank you, Ann, for your many years of reliable service to the department!

Faculty Scholarly Achievements

Publications

- **Steven T. Ratliff** and Kawsu Barry, "Characterization of Ivoclar Vivadent Dental Restoration Material for ^{137}Cs Retrospective Radiation Dosimetry," *Health Physics*, Vol. 115, No. 2, pp. 212-220 (August 2018).
- 2018 **Annette Lee**, "The Cosmos as Viewed Through the Lens of a Native-American Astronomer-Artist," pg. 203-220, *Imagining Other Worlds*, edited by N. Campion and C. Impey, Inspiration of Astronomical Phenomena (INSAP) IX, Gresham College, London, Sophia Centre Press 2018.
- 2019 **Annette Lee**, "Celestial Calendar-Paintings and Culture-Based Digital Storytelling: Cross-Cultural, Interdisciplinary, STEM/STEAM Resources for Authentic Astronomy Education Engagement," EPJ Conf. Proc. in Physics and Astronomy, International Symposium on Education in Astronomy and Astrobiology" (ISE2A-IAU), Utrecht, Netherlands, 2019.
- 6/2019 **John E. Sinko** and Chase D. Negen, "Experimental Study on Microsecond Laser Ablation of Simulated Aluminum Space Debris Targets," AIAA-2019-3565, AIAA Aviation Forum, Dallas, TX, 2019.

Awarded Faculty Grant Proposals

2018 Annette Lee (PI)

\$10,000

Australian-US Embassy Scholar, University of Southern Queensland, Centre for Astrophysics, Australia

10/2018 Annette Lee (PI)

AAS Education and Professional Development Mini-Grants

\$7,306

"Skywatchers: Bringing Together Cultural and Scientific Knowledge of the Stars"



Annette S. Lee at the Sir Thomas Brisbane Planetarium, Brisbane, New South Wales, Australia, Aug. 2018, presentations at the Brisbane Planetarium Astronomy



Annette S. Lee at the Centre for Astrophysics, Mt Kent Observatory, Toowoomba, University of Southern Queensland, Australia

12/2018 John Sinko (PI)

SCSU Saigo Travel Grant

\$460

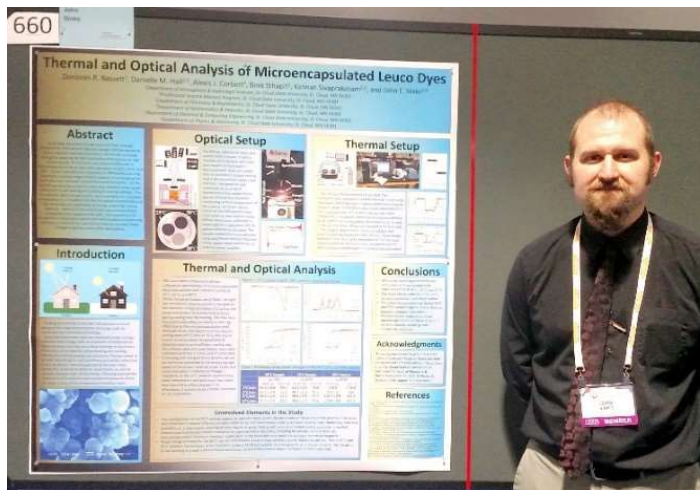
"Thermal and Spectral Analysis of Microencapsulated Leuco Dyes"

Professional Presentations

- 11/2018 Donovan R. Bassett, Danielle M. Hall, Alexis J. Corbett, Binit Sthapit, Kannan Sivaprakasam, and **John E. Sinko***, "Thermal and Optical Analysis of Microencapsulated Leuco Dyes," poster presentation in 2018 Materials Research Society Fall Meeting, Boston, MA, November 2018.
- 2019, **Annette Lee***, American Astronomical Society (AAS) 234th Meeting, Plenary-Invited Speaker, St. Louis, Missouri
- 2019, **Annette Lee***, Am. Assoc. for the Advancement of Science (AAAS), Dialogue on Science, Ethics & Religion, Invited Talk
- 2019, **Annette Lee***, Adler Planetarium, Webster Distinguished Lecturer IAI, Invited Talk, Chicago, Illinois
- 2019, **Annette Lee***, Minnesota Geoscience Teachers Conference, Keynote Speaker, Minneapolis, Minnesota
- 2018, **Annette Lee***, Invited Talk, International Expert Meeting, Astronomical Heritage & Sacred Places, Gran Canaria, Spain.
- 2018, **Annette Lee***, Invited Colloquium Talk, Department of Astronomy University of Toronto, Ontario, Canada
- 2018, **Annette Lee***, Keynote Speaker, Maamwizing Indigenous Conference, Laurentian University, Sudbury, Ontario
- 2018, **Annette Lee***, Keynote Speaker, Environmental Education Association of Oregon, Portland, Oregon
- 2018, **Annette Lee***, Invited Public Talk, US Embassy Scholar, Univ. of Southern Queensland, National Science Week
- 2018, **Annette Lee***, Invited Colloquium Talk, US Embassy Scholar, Univ. of Southern Queensland, Centre for Astrophysics
- 2018, **Annette Lee***, Invited Talk, American Indian/Alaskan Native Working Group Lead, NASA Science Mission Directorate
- 2/2019 **Annette Lee**, oral presentation in "Skywatchers: Bringing Together Cultural and Scientific Knowledge of the Stars", a Workshop for Astro 101 Instructors and Native American K-12 Educators
- 3/2019 **John E. Sinko**, SCSU ISELF Symposium, "Update on Usage of Optics Spaces"
- 3/29/2019 **Todd Vaccaro**, Dave Williams, and Mark Gill, Public Nights observing and 3D Cave ("Holodeck") presentation of the Solar System, untitled.
- 6/2019 **John E. Sinko*** and Chase D. Negen, oral presentation in AIAA Aviation Forum, Dallas, TX, June 2019.



Annette S. Lee presenting at the Skywatchers—Bringing Together Cultural and Scientific Knowledge of the Stars Workshop in 2019 at ʔaʔkʷustəŋáwtxʷ House of Learning, Peninsula College Longhouse, Peninsula College Longhouse, Port Angeles, Washington, USA. The Longhouse features Ceremonial Screen by Jimmy Price, Port Gamble S'Klallam.



John Sinko presents a poster on leuco dye heat capacities and enthalpies at the Fall 2018 Materials Research Society meeting in Boston, MA.

Awards

- 2018, **Annette Lee** was awarded as the AUS Embassy Scholar, University of Queensland, Centre for Astrophysics
- 2018-Present, **Annette Lee**, awarded Honorary Adjunct Associate Professor, Centre for Astrophysics, University of Southern Queensland, Australia
- 2019, **Annette Lee** was a Distinguished Lecturer by the Archaeological Institute of America, Webster Lectureship
- 2019, **Annette Lee** was awarded as the American Astronomical Society Shapley Lecturer
- On 4/17/2019, **Dr. Kevin Haglin** and **Dr. John Sinko** were both awarded **Minnesota State Educator of the Year** awards after being selected as **SCSU Outstanding Educators** by President Wacker. Only six Educator of the Year awards were made in the entire Minnesota State Colleges and Universities System. The Board of Trustees awards each included a plaque, a medallion, and \$5000 in professional development funds. Also honored as SCSU Outstanding Educators were ETS professor Nancy Sundheim, and Biology professor Matt Julius.



Kevin Haglin receiving 2019 Board of Trustees Educator of the Year award for Excellence in Teaching



John Sinko receiving 2019 Board of Trustees Educator of the Year Award for Excellence in Teaching



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OUR STUDENTS NEED YOUR SUPPORT!

Supporting students is our number one goal.

We owe it to them to provide the resources necessary to continue to be at the forefront of applied research in the state and region.

The costs of providing real-world experiential opportunities continue to rise.

With your generosity and support we will recruit and retain students with scholarship assistance, we will engage them in enhanced experiences using the most up-to-date technology and instrumentation, and we will assist them in building and presenting research through student professional development funds.

Please consider helping our students with your gift today!



Name _____

Address _____

City _____ State _____ Zip _____

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 4th Ave. South
St. Cloud, MN 56301-4498

THANK YOU FOR YOUR SUPPORT!