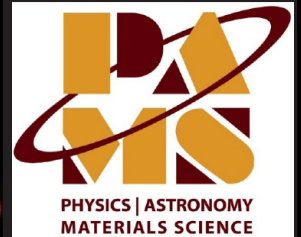


# M o m e n t u M



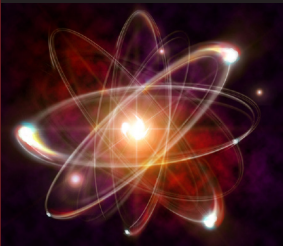
Newsletter  
2018-2019



## A Note from the Department Head

This has been a year of transitions. Dave Cornelison stepped down as Department Head after serving in the position for eight years. The department owes Dave a deep debt of gratitude for his service during his tenure as the Department Head. Dave was able to set the priorities for the department and to provide the needed leadership to develop and set into action our recent Action Plan based on the review of the department in 2017. In addition, he helped to forge important ties to local industry requiring either well-trained students or research expertise from some of our faculty. Dave hosts a popular local science-based radio show that he has originated, named STEM Spots, which airs on KSMU. In the radio show, he discusses current topics of interest in the fields of science and technology with scientists, educators and industry leaders. He has also developed a school physics demonstration project. The demonstrations are transported to local schools using the PhyzBiz truck which, on its own, is an ingenious bit of advertising for physics. Dave has settled into his new role as a faculty in the department while still carrying on specific initiatives that he has started in his role as a Department Head, while occasionally providing sage advice to the new Department Head.

Among other notable events, two new faculty have joined PAMS in the Fall of 2018 at the assistant professor position, Dr. Sarah Morrison and Dr. Tiglet Besara. Dr. Morrison joins us from Penn State University, where she is presently on leave until Fall of 2019 from her position while finishing up a NASA Postdoctoral Fellowship. Sarah obtained her PhD in planetary sciences from the University of Arizona. Dr. Besara joins us from Florida State University where he was a postdoctoral



# M o m e n t u M



fellow at the National High Magnetic Field Laboratory. Tiglet obtained his PhD in chemical physics from Florida State University.

The PAMS Advisory Board had its annual meeting during Homecoming Weekend, Oct. 25, 2018, and provided many useful suggestions in helping to guide the department into the near future. The department held several successful public viewing nights at Baker Observatory during 2018. We have a great new instrument addition to Baker Observatory, a Plane Wave Instruments CDK20 20" telescope, which includes the drive mount, CCD detector and other components. The new telescope was installed in June, 2018. We look forward to the new exciting results that will be acquired in the future using the new telescope.

*Dr. Robert Mayanovic*

## Baker Observatory Update

Baker Observatory, located about 25 miles from Springfield, is a place where researchers can take an up-close look at the stars. It's also open to the public several times a year. In the 1980s, Kitt Peak National Observatory in Arizona permanently loaned MSU their site survey telescope with the help of professor emeritus Dr. George Wolf. The telescope was made in the 1950s. In the past few years, the telescope suffered normal wear and tear that made using the telescope difficult.

"Baker Observatory is the only research telescope in Missouri," said Dr. Michael Reed, professor of astronomy. "I have published over a dozen research papers with data from our previous telescope. In addition, we use it for student training, classes and public outreach."

Dr. David Cornelison, professor of physics, saw the telescope was basically unusable. Rather than sacrifice valuable research, he knew that something had to be done. Repairs were out of the question. They would cost as much as a new telescope. Funding from the provost's office, the College of Natural and Applied Sciences (CNAS) and the physics, astronomy and material science department, paired with Cornelison's thrifty telescope-finding made getting a new telescope a reality.

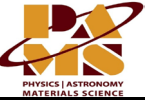
In addition to the new Plane Wave Instruments CDK20 20" telescope, the control room and other parts of Baker Observatory were updated as well.

"My favorite part of the process was seeing a 30-year-old facility get revamped and looking new again," Reed said. "CNAS's machinist, Brian Grindstaff, David Cornelison and I spent many hours stripping off the old and making it new again."





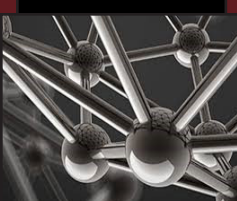
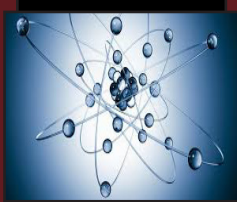
# M o m e n t u M



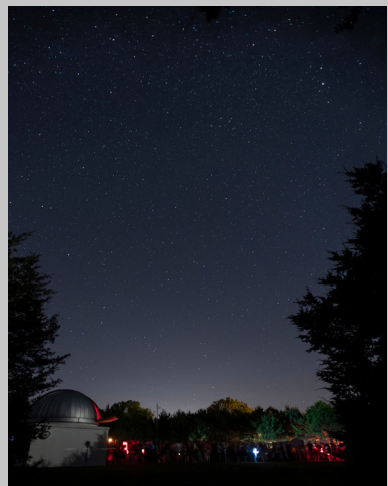
With the new telescope comes more exposure to the skies. The new telescope can see objects more than 50 percent fainter.

“One of the most important things we do at Missouri State is foster the next generation of scientists,” Reed said. “There really is no better teacher than getting ‘hands-on’ experience using this type of equipment. We hope for years of discoveries with our new facility.”

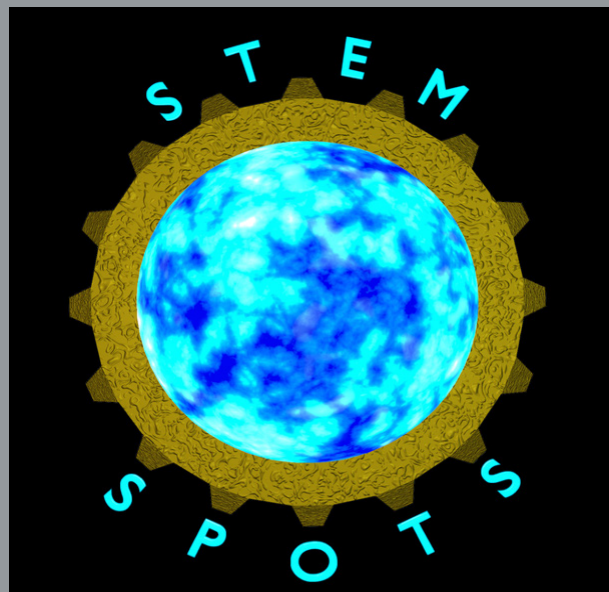
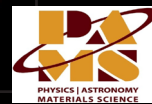
All renovations were made and the new telescope was ready for use by the fall semester, and the PAMS department hosted its first Public Observing Night at Baker Observatory for the Fall 2018 semester on Sept. 14. The event was a great success—the estimated number of attendees was between 500 to 600 people on a night featuring splendidly clear skies. The observatory’s featured instrument was the newly installed 20” telescope, which provided great images of Saturn, Mars, our Moon and other celestial objects. The department wishes to thank the **Ozarks Astronomy Club** and the participating PAMS faculty and students for making this a successful event.



**Public  
Observing  
Night  
at  
Baker  
Observatory**



# M o m e n t u M



## STEM SPOTS

**STEM SPOTS** is a radio show about science, technology, engineering and mathematics (STEM). It is hosted by our own Dave Cornelison with Becky Baker occasionally standing in. Stem Spots aired it's 100th episode in November of 2017. 2018 saw it continue into it's 4th year of broadcasting on KSMU. As is typical of the show, the year saw a wide coverage of STEM-related subjects including local zoo animals, women in STEM, topological crystals, religion and

science, biomathematics and finite time / geometrical thermodynamics, biocrusts, chaos, the new Mars mission, restoration ecology, salamanders of the Ozarks, and hybrid nanoscale materials. Guests on the show included MSU's faculty and students, individuals from the community and from outside universities and institutions

## Intellectual Contributions 2018 - 2019

### Department of Physics, Astronomy, and Materials Science

Ghosh, Kartik C. (Full Professor)

Mayanovic, Robert A. (Distinguished Professor)

Mitra, Saibal (Full Professor)

Professor)

Reed, Michael D. (Full Professor)

Redd, Emmett (Full Professor)

Sakidja, Ridwan (Associate

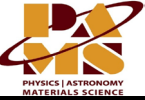
The 2018 year saw yet again considerable productivity from PAMS faculty and students in terms of intellectual contributions. The department published 25 scientific papers in scientific journals during the year. In addition, a number of oral and poster presentations were made by the faculty and students during the year.

Dr. Kartik Ghosh gave a talk at a scientific workshop in India in January of 2018. During the same time, he gave two additional talks at research institutes in India.

Dr. Ridwan Sakidja and his graduate students made several presentations at the Materials Science & Technology (MS&T) 2018 Meeting in Columbus, OH, in October 2018. In addition, Dr. Sakidja gave an invited seminar talk at the University of



# M o m e n t u m



Kansas and presented a talk on his research at the 2018 Annual Review Meeting for Crosscutting Research organized by the Department of Energy. Dr. Emmett Redd gave a poster presentation at the Cognitive Computing Conference in December 2018 in Hannover, Germany.

PAMS students Josh Kern and John Crooke presented at the American Astronomical Society Meeting in January 2018. Six PAMS undergraduate students presented research talks and posters at the Arkansas IDEa Network of Biomedical Research Excellence (INBRE) Conference, at the University of Arkansas in Fayetteville in November 2018. In addition, eight undergraduate PAMS students gave presentations at the annual NASA Missouri Space Grant Consortium Meeting held in April, 2018, in Rolla, MO. Seven PAMS graduate students made presentations at the 2018 Einhellig Interdisciplinary Forum, at Missouri State University in May 20

Please follow our link to see the many outstanding intellectual contributions made by our faculty and students in the last two years.  
<https://physics.missouristate.edu>

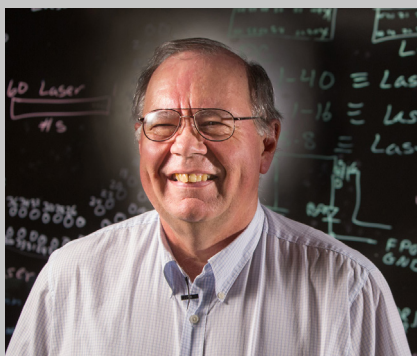
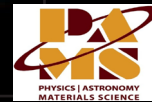


**Above:** PAMS students (left) Tyler McGilvrey-James (from left to right starting in the middle panel) Wes Renfrow, Chris Klenke, Devon Romine, Daniel Fishbein and Austin Bollinger (extreme right panel) at the INBRE conference.

**Right:** Dr. Ridwan Sakidja and PAMS graduate students Sabila Kader Pinky (extreme left), Nirmal Baishnab (second from right) and Rajan Khadka (extreme right) at the MS&T 2018 conference.



# M o m e n t u M



## Why digital computers cannot mimic the human brain

**Dr. Emmett Redd defends this statement with mathematical theorems.**

**Dr. Emmett Redd**, professor of physics, astronomy and materials sciences, attended the Cognitive Computing conference in Hannover, Germany, Dec. 18-20, 2018. The conference focused on alternatives to digital computers for mimicking the cognitive abilities of the human brain.

He explored theorems that could support computing on physical systems other than digital computers. "My research points toward fundamental mathematical theorems that show how brains and unconventional computing devices have higher processing capability that results from noisy analog signals," Redd said.

After submitting his abstract for the conference, Redd said he had a "Eureka moment." Through his research, he linked together stochastic resonance, when white noise is added to a signal to improve its detection, and a theorem about the processing capabilities of the brain. "We believe that this is a significant theoretical advance for making neural networks operate more like a brain does," Redd said.

Dr. Redd and his Missouri State co-authors described the linkage in a poster for the conference. His co-authors include Dr. A. Steven Younger, physics, astronomy and materials science faculty researcher, and Dr. Tayo Obafemi-Ajayi, assistant professor of electrical engineering.

They also submitted an extensive paper to the International Joint Conference on Neural Networks.

## Student Opportunity for Excellence

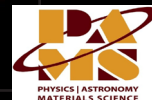
Many of our students have been given the opportunity to travel, attend conferences, present research, and to show their excellence. Here are a few examples.

**Diwash Dhakal**, is a MSU Materials Science graduate student from Nepal. He was recently involved with experiments at the Advanced Photon Source (APS) synchrotron, which is a high-energy electron storage ring that creates very intense x-rays. The experiments deal with issues of storage and disposal of radioactive materials, such as spent uranium from nuclear reactors. The photograph shows Diwash at the control console of sector 20 x-ray beam line at the APS. Diwash is funded through a joint project with Los Alamos National Laboratory.



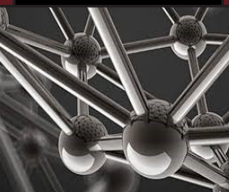
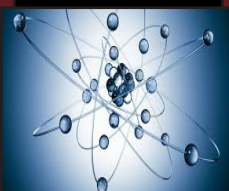
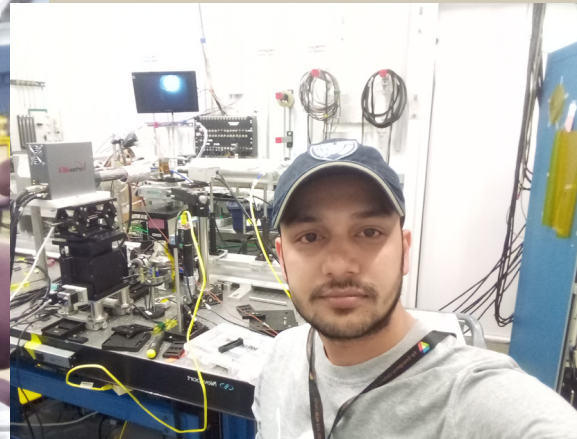


# M o m e n t u M

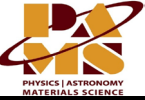


## Argonne National Laboratory

In April, 2018 Diwash Dhakal and Dr. Bob Mayanovic traveled to the Advanced Photon Source in Argonne National Laboratory in Illinois. While there, they were able to acquire X-Ray Absorption Spectroscopy data from their research experiment. This project involves studies of actinides, such as depleted uranium, interacting with water at high temperatures and pressures and is made in collaboration with scientists from Los Alamos National Laboratory (LANL). The results from this project will provide a fundamental understanding of the physicochemical properties of actinides in extreme aqueous environments that are vastly different from those currently known. The work will be made as the primary component of Diwash's thesis project and involves working with a type of high pressure cell called the diamond anvil cell.



# M o m e n t u M



## Learn about the stars without leaving Earth

**Josh Kern has made several exciting star discoveries without leaving Missouri State.**

We've walked on the moon. We've discovered new planets. However, one thing that is difficult to understand are the insides of stars.

When we look at stars with telescopes, we only see the outer layers. At Missouri State University, we've been lucky to look at stars with one of the most influential telescopes ever made: the Kepler space telescope.

Though it's not as easy as getting up close, the PAMS department has their ways of "seeing" into the stars thanks to Kepler.

"Just like geologists use earthquakes and seismology to determine the internal structure of the Earth, astrophysicists use stellar pulsations and asteroseismology to determine the internal structure of stars," said Josh Kern, a graduate student working with Dr. Mike Reed, professor of astronomy.

Kern analyzed these pulsations and made several new discoveries.

### **What he found**

Kern was able to make some exciting and unexpected discoveries. They include information about the internal structure, like chemical composition changes that reflect pulsations in the core of a star. He also learned about the macroscopic properties, including how fast the star spins and that we are looking at its equator and not its poles.

One of the discoveries was something he and Reed had never seen before.

Kern says this means they may have discovered new physics.

### **Why this is important**

Understanding stars is a process; theoreticians make models of the stars and Kern has to go look for those traits. With his new discovery, he gives information to the theoreticians, and they construct models based on his information.

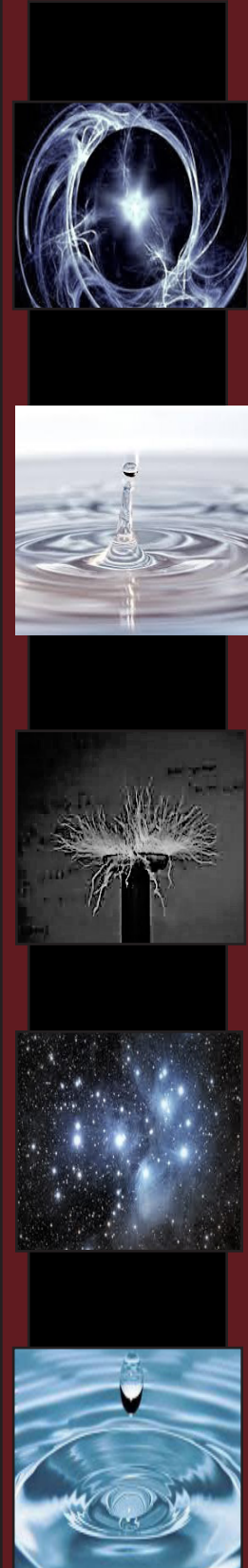
Kern says the anticipation of the discovery is what he enjoys most.

"Knowing that I am only one of maybe a few dozen people in the world who will ever look at this star is an exciting experience," Kern said.

Kern recently had his article, "Asteroseismic analysis of the pulsating subdwarf B star KIC 11558725: an sdB+WD system with divergent frequency multiplets and mode trapping observed by Kepler" published.

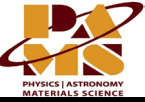
These results were presented by Reed at the Meeting on Hot Subdwarfs and Compact Objects in Krakow, Poland, July 2017. Kern also presented these findings in January 2018 at the 231st American Astronomical Society meeting in Washington, D.C.

"Without Dr. Reed, none of my work would have been possible," Kern said.





# M o m e n t u M



## Some Photos from Our 2018 Events



Pictures Left (from PAMS):  
Dr. Ridwan Sakidja and Chris Klenke  
at INBRE.



Pictured Right: Rajan Khadka,  
Dr. Ridwan Sakidja, Nirmal Baishnab,  
Sabila Pinky, and Zachary Leauty at the  
IDF meeting.



Pictured Left (from PAMS):  
Rajan Khadka, Dr. Robert  
Mayanovic, and Wes Renfrow  
at Summer Science Camp.

Pictured Below: Drs. Robert  
Mayanovic and Kartik Ghosh,  
Sanchali Das, Nirmal Baishnab,  
Sabila Pinky, at the IDF meeting.

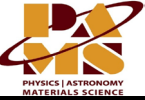


Pictured Left:  
Sanchali Das  
with poster  
presentation  
at the IDF  
meeting.





# M o m e n t u m



## Graduates 2018 - 2019

### Spring 2018

John Crooke  
Shane Gumm  
Calbi Gunder  
Joshua Kern  
Zachary Leuty  
Jesse Underwood

### Summer 2018

Jing Bian  
Ahmed Mahbub  
Muhammad Shattique

### Fall 2018

Jeremy Loden  
David Magness

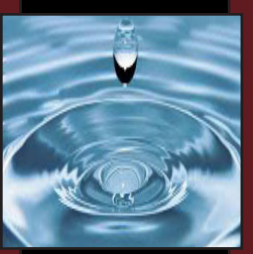
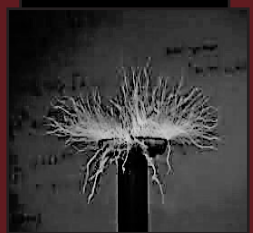


**Pictured Right:** CNAS students, including from PAMS, at the CNAS Graduation Reception in May, 2018.

**Pictured Right:** Dr. Ridwan Sakidja with MS Materials Science Spring 2018 graduates (from left to right) Zach Leuty, Muhammad Shattique, and Ahmed Mahbub. Paraphrasing Doc Brown from Back to the Future, "Is there a problem with Earth's gravitational pull here?"

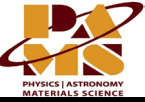


**Pictured Left:** Dr. Robert Mayanovic with PAMS Spring 2018 graduates (from left to right) Ahmed Mahbub, John Crooke, Zach Leuty, and Calbi Gunder.





# M o m e n t u M



## Faculty Excellence Awards



**Dr. Ridwan Sakidja received the MSU Foundation Award for Research in 2018.**

Dr. Sakidja has authored or co-authored about 20 journal publications and has presented or was a co-author on student presentations at national meetings, regional conferences and MSU events. He obtained several major externally funded grants, and a number of minor funded grants, totaling nearly \$500K since his becoming a faculty member in the PAMS department. The award comes with a \$3,600 prize.

**Dr. David Cornelison was awarded the 2018 student-nominated CNAS Faculty Excellence Award.** Students said that Dr. Cornelison was an inspiration and always willing to listen and help a student succeed. Graduate student Shattik Rubaiyat Muhammad who made the nomination is shown in the photograph to the right with Dr. Cornelison.



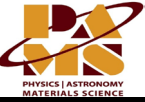
## 2018 Scholarship Winners

Andereck Family Scholarship  
Banks Family Scholarship  
Kenneth Soxman Memorial Scholarship  
PAMS and Friends Scholarship  
PAMS Dept. Scholarship Fund

Thomas Cave Astronomy Scholarship  
Thurman Family Scholarship  
Pre-Engineering/Engineering Physics

Cassidy R. Johnson  
Alyssa J. Aumann, Cory Padgett  
Tyler McGilvry-James  
Kody Anderson, Anne Westrich  
Yadira Gaibor, Cassidy Johnson,  
Kody Anderson, Alyssa Aumann  
Yadira Gaibor  
Christopher Klenke  
Preston Clubb

# M o m e n t u M



## PAMS Alumni & Friends



**Pictured Left:** Dr. Sakidja with Anagh Bhaumik, a 2014 graduate with a MS in Materials Science from our department. Anagh has completed his PhD studies in Materials Engineering North Carolina State University.



**Pictured Right:** Adolfo (Andrew) Cancino, a BS Physics major in the department.



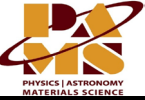
**Pictured Above:** Julie Barnum, a 2015 alumni who graduated with a BS in Physics and went on to obtain her MS in Atmospheric Science and Meteorology from Colorado State.



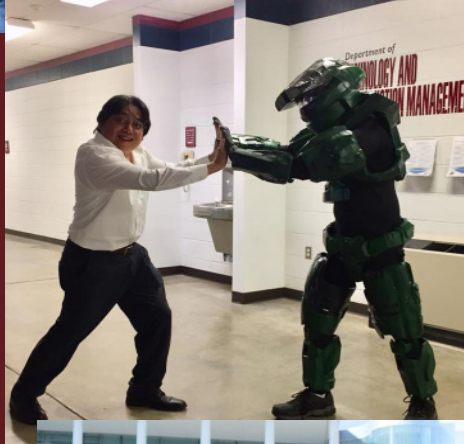
**Pictured Below:** Sarah Gamm, a 2006 BS in Physics graduate and an Advisory Board member of our department.



# M o m e n t u M

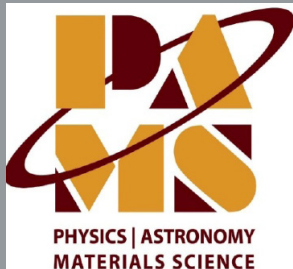


## Down Time



What do PAMS students and faculty do when they are not science-ing? They are participating in community service and extracurricular activities with the rest of the PAMS family.

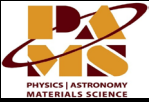
## Media & Contact Information



Please visit us on Facebook at [www.facebook.com/MSUPAMS2/](http://www.facebook.com/MSUPAMS2/)  
You can reach us by e-mail at [Physics@MissouriState.edu](mailto:Physics@MissouriState.edu)  
If you wish to speak to one of our staff, please call 417-836-5131  
Our mailing address is:

**The PAMS Department**  
Kemper Hall 101  
901 S. National Ave.  
Springfield, MO 65897

# M o m e n t u M



Please take a few minutes to send us an email at: [physics@missouristate.edu](mailto:physics@missouristate.edu). Include your current contact information, graduation year and Missouri State degree. Let us know where you are working now, job title or other career or personal accomplishments so we may include you in the next issue. Stay current with the MSU Alumni Association at <http://alumni.missouristate.edu>. Update your contact information online and learn about upcoming alumni events, such as MarooNation. Staying Connected.

State universities could not operate without generous contributions from alumni and friends. Your support enables us to provide scholarships, teaching equipment, and more. We hope you will consider making a contribution to the PAMS department or to one of the scholarships; your gift is tax deductible. To learn more about how you can help, visit <http://physics.missouristate.edu/Alumni.htm>. Please make checks payable to **Missouri State University Foundation** in support of the PAMS department and mail to:  
The PAMS Department  
Kemper Hall 101  
901 S. National Ave.  
Springfield, Missouri 65897.  
Also, donations can be made online at: [www.missouristatefoundation.org/waysofgiving.asp](http://www.missouristatefoundation.org/waysofgiving.asp). Select Natural & Applied Sciences/Physics, Astronomy, & Materials Science.

Thank you!

## Faculty and Staff

Baker, Rebecca	<a href="mailto:BeckyBaker@MissouriState.edu">BeckyBaker@MissouriState.edu</a>	Morrison, Sarah	<a href="mailto:SJMorrison@MissouriState.edu">SJMorrison@MissouriState.edu</a>
Besara, Dr. Tiglet	<a href="mailto:TigletBesara@MissouriState.edu">TigletBesara@MissouriState.edu</a>	Nag, Nandita	<a href="mailto:NanditaNag@MissouriState.edu">NanditaNag@MissouriState.edu</a>
Cornelison, Dr. David	<a href="mailto:DavidCornelison@MissouriState.edu">DavidCornelison@MissouriState.edu</a>	Patterson, Dr. Robert	<a href="mailto:RSPatterson@MissouriState.edu">RSPatterson@MissouriState.edu</a>
Fritz, Marla	<a href="mailto:Marla123@MissouriState.edu">Marla123@MissouriState.edu</a>	Redd, Dr. Emmett	<a href="mailto:EmmettRedd@MissouriState.edu">EmmettRedd@MissouriState.edu</a>
Frodermann, Dr. Evan	<a href="mailto:EFrodermann@MissouriState.edu">EFrodermann@MissouriState.edu</a>	Reed, Dr. Michael	<a href="mailto:MikeReed@MissouriState.edu">MikeReed@MissouriState.edu</a>
Ghosh, Dr. Kartik	<a href="mailto:KartikGhosh@MissouriState.edu">KartikGhosh@MissouriState.edu</a>	Rios, Laura	<a href="mailto:LauraRios@MissouriState.edu">LauraRios@MissouriState.edu</a>
Huang, Dr. Shyang	<a href="mailto:ShyangHuang@MissouriState.edu">ShyangHuang@MissouriState.edu</a>	Sakidja, Dr. Ridwan	<a href="mailto:RidwanSakidja@MissouriState.edu">RidwanSakidja@MissouriState.edu</a>
Mayanovic, Dr. Robert	<a href="mailto:RobertMayanovic@MissouriState.edu">RobertMayanovic@MissouriState.edu</a>	Younger, Dr. Steven	<a href="mailto:SteveYounger@MissouriState.edu">SteveYounger@MissouriState.edu</a>
Mitra, Dr. Saibal	<a href="mailto:SaibalMitra@MissouriState.edu">SaibalMitra@MissouriState.edu</a>		

## Emeritus (2018-2019)

Giedd, Dr. Ryan	<a href="mailto:RyanGiedd@MissouriState.edu">RyanGiedd@MissouriState.edu</a>	Thurman, Dr. Robert	<a href="mailto:RobertThurman@MissouriState.edu">RobertThurman@MissouriState.edu</a>
Manivannan, Dr. Kandiah	<a href="mailto:ManiManivannan@MissouriState.edu">ManiManivannan@MissouriState.edu</a>	Whitaker, Dr. Robert	<a href="mailto:RJWhitaker@MissouriState.edu">RJWhitaker@MissouriState.edu</a>
Thomas, Dr. William	<a href="mailto:WilliamThomas@MissouriState.edu">WilliamThomas@MissouriState.edu</a>	Wrinkle, Dr. Cheryl	<a href="mailto:CherylWrinkle@MissouriState.edu">CherylWrinkle@MissouriState.edu</a>

## MOMENTUM

The Newsletter of the Department of Physics, Astronomy, and Materials Science at Missouri State University  
To submit information for the next Momentum newsletter, e-mail Marla Fritz at [Momentum@MissouriState.edu](mailto:Momentum@MissouriState.edu) or [Marla123@MissouriState.edu](mailto:Marla123@MissouriState.edu)

## CONTENTS

A Note from the Department Head	1-2	Graduates in 2018	10
Baker Observatory Update	2-3	Faculty Excellence Awards	11
Stem Spots	4	Scholarship Winners	11
Intellectual Contributions for 2018	4-5	PAMS Alumni & Friends	12
Why Computers Can't Mimic the Brain	6	Down Time	13
Student Opportunities for Excellence	6-7	Media and Contact Info.	13
Learn About the Stars w/o Leaving Earth	8	Referances and Contents	14
Events and Trips in 2018	9		

Missouri State University adheres to a strict nondiscrimination policy and does not discriminate on the basis of race, color, religion, sex, national origin, ancestry, age, disability or veteran status in any program or activity offered or sponsored by the University. Prohibited sex discrimination encompasses sexual harassment, which includes sexual violence. In addition, the University does not discriminate on any basis (including, but not limited to, political and sexual orientation) not related to the applicable educational requirements for students or the applicable job requirements for employees. This policy shall not be interpreted in a manner as to violate the legal rights of religious organizations or military organizations associated with the Armed Forces of the United States of America.

Missouri State University is an equal opportunity/affirmative action institution. Questions concerning compliance with regulations may be directed to the Office for Institutional Equity and Compliance, 901 South National Avenue, Springfield, Missouri 65897, [equity@missouristate.edu](mailto:equity@missouristate.edu), 417-836-4252, or to the Office for Civil Rights, 417-836-4252.