

[Click Here to view the web version of this email](#)



UNIVERSITY OF KENTUCKY · COLLEGE OF ARTS & SCIENCES

Department of Physics & Astronomy



Greetings from the Department

December 2020

Dear Alumni and Friends,

It has only been half a year since our last newsletter, but it seems much longer. Like every department in every university, we have experienced unprecedented stresses and challenges since March 2020. On top of the pandemic, we have also been dealing with budget issues and disruptions due to the ongoing renovation of the Chemistry-Physics Building. But we're pleased to report that, having made it to the end of the year, we find ourselves doing remarkably well.

Our teachers—faculty, instructors, and graduate TAs—did a phenomenal job of adapting to online instruction. After abruptly moving the majority of our courses online in March, everyone taught their fall semester courses like seasoned pros. Our talented Lab Coordinators, Max Brown and Maxwell Ankrah, put together a beautiful suite of mostly-online labs for our introductory courses. New graduate students who were unable to travel to the U.S. were nevertheless able to begin their studies by joining courses remotely from as far away as India and China. Our colloquium and seminar series resumed over Zoom at full activity, with distinguished speakers from all over.

Physicists and astronomers are no strangers to online research, and discussions and group meetings continued apace throughout the lockdown. Faculty used the time away from their labs to write papers and grant proposals. Starting in early June, experimentalists began moving back into their labs; lab activity is still not all the

way back to normal due to safety restrictions, but all labs are operating and moving forward with research. Other measures of research are encouraging: we led the College of Arts and Sciences in grants received during the 2020 fiscal year, bringing in \$3.5 million in federal funding, and are on track for another good year. And we graduated 12 truly impressive Ph.D.'s, who have moved on to postdocs and other exciting jobs around the world (see below). We are proud of all of them.

Our faculty continued to receive honors for their achievements. Renee Fatemi was named a University Professor for 2020-21, following Susan Gardner's award for the previous year. Sumit Das capped his year as A&S Distinguished Professor with a memorable public talk on "Deconstructing Spacetime" in October. Tom Troland won the A&S Outstanding Teaching Award, and Chris Crawford won a University-wide Great Teacher Award.

The renovation of the Chemistry-Physics Building has continued at full steam. We are all looking forward to having a building with a shiny new exterior (and a new loading dock and service elevator!) by mid-2022, and we hope to see our interior spaces renovated before too long. There will be many impressive naming opportunities for those who would like to invest in the future of our department.

We're proud of the many ways our faculty, staff, and students have risen to the challenges of the last few months, and we look forward to returning to normal operations before long.

With best wishes to all for a safe, happy, and productive new year,

Al Shapere
Department Chair
shapere@g.uky.edu
177F Chemistry-Physics Building

Brad Plaster
Associate Chair
brad.plaster@uky.edu
281 Chemistry-Physics Building

Astronomy Student Leads Study on Shape, Structures of Milky Way Galaxy

Austin Hinkel, a doctoral student in the University of Kentucky Department of Physics and Astronomy, is the lead author of a paper that was published in April 2020 in the *Astrophysical Journal*.

The study, "Probing Axial Symmetry Breaking in the Galaxy with Gaia Data Release 2," was led by Hinkel along with co-authors Susan Gardner, professor of physics and astronomy in the UK College of Arts and Sciences, and Brian Yanny, a staff scientist and astrophysicist in the Fermilab Center for Particle Astrophysics in Batavia, Illinois.

"Using powerful ideas borrowed from nuclear and particle physics, we explore the axial symmetry, or axisymmetry, of the galaxy—that is, if one looks out from the center of our galaxy, toward the sun, does the disk of the Milky Way look the same left and right?" Hinkel said. "We check this by counting up the stars near the sun and comparing their distributions left and right." [Read more.](#)

To view Hinkel's recent 3MT talk, for which he is a finalist, go to:

<https://www.youtube.com/watch?v=FI-wTxJ3Sks>



Doctoral student Austin Hinkel

Professor Chris Crawford Directs 3 Undergraduate Students' Summer Research Project on Neutron Lifetime

UK undergraduates Emily Ballantyne and Rebecca Calvert and WKU undergraduate Sarah Vickers carried out a research project under UK Professor Christopher Crawford in summer 2018. Their project was a part of a quest to solve a persistent discrepancy between two different types of measurements of the neutron lifetime, which disagree by over four standard deviations (see figure below).

Known as the beam and bottle methods, the former measures the in-flight decay rate normalized by the number neutrons in the beam and the length of the decay region, while the second measures the exponential decay curve as a function time, as neutrons are stored for times comparable to the 15 minute lifetime. [Read more.](#)



(Left to right) Crawford, Vickers, Calvert and Ballantyne at the BL3 Collaboration meeting at the NIST Conference.

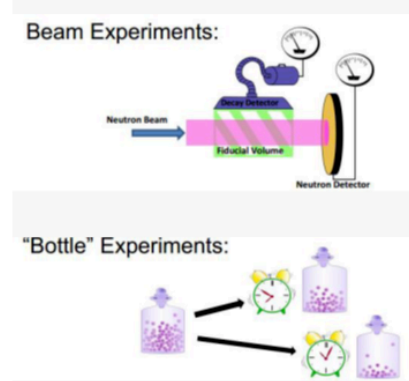
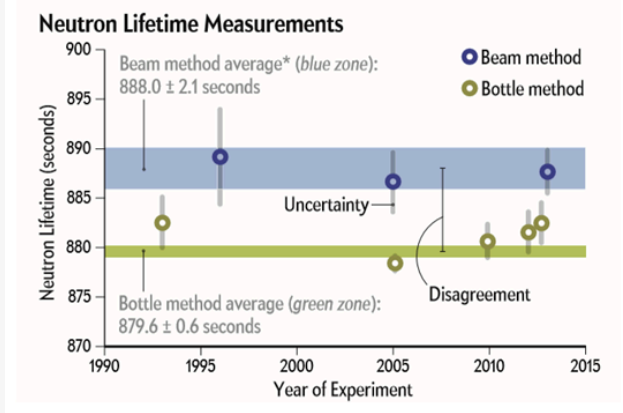


Figure 1.

Undergraduate Research Profile: Josh Harry

In the past year, undergraduate physics major Josh Harry has been conducting research with Professor Ron Wilhelm on the cause of year-to-year pulsation frequency shifts in the variable star RU Piscium.

This pulsating variable star has been observed intensively at the MacAdam Student Observatory for the past two years. Analysis of our high precision light curves suggest that cycle-to-cycle changes are occurring in RU Piscium. The goal of this project is to determine if these rapid fluctuations are directly related to the much longer time scale frequency shifts.

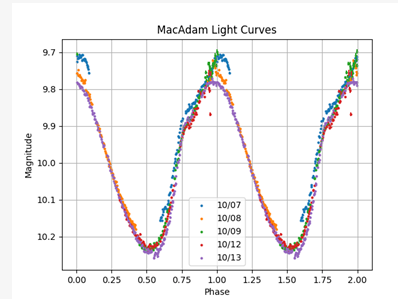


Figure 1. Plots showing that changes in the compression hump size and the time of maximum light are correlated to changes in pulsation velocity during the atmospheric in-fall phase.

In October 2019, Josh and several other team researchers conducted photometric observations of the star, simultaneous with high resolution spectroscopy observations that were occurring at McDonald Observatory. These observations were critical for comparing cycle-to-cycle light curve fluctuations to that of fluctuations in the radial velocity curves.

Along with helping to obtain the simultaneous light curves, Josh completed data reduction and analysis on all observations (Figure 1). He also wrote a Python code to determine the size of the compression hump (a thermal emission that occurs when in-falling layers collide with out-flowing layers) and the time of the light maximum.

Coupling his results with that of the radial velocity curves from spectroscopy (Figure 2), we have been able to find a relationship between slow atmospheric in-fall and large compression humps with delayed time of maximum light.

Josh is using his new routine to analyze other variable star light curves from the Transiting Exoplanet Survey Satellite (TESS) to identify other stars with characteristics similar to RU Piscium. His efforts will help determine a link between cycle-to-cycle fluctuations and long scale frequency shifts. His research on RU Piscium was accepted for presentation at the National Conference on Undergraduate Research in 2020.



Undergraduate physics major Josh Harry

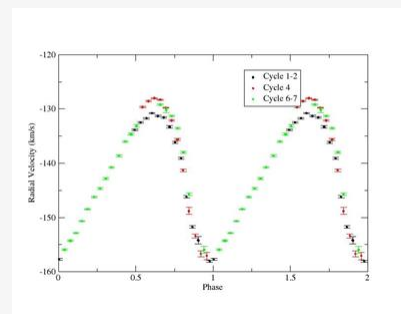


Figure 2.

Astronomy New Faculty Profile: Yuanyuan Su

Yuanyuan Su joined the University of Kentucky as an assistant professor of astronomy in 2019 after being a postdoc at the Harvard-Smithsonian Center for Astrophysics.

She is originally from Sichuan, China, the hometown of giant pandas. Su received her Ph.D. from the University of Alabama and went on to a postdoc in California before moving to Harvard.

Her primary research interest lies in clusters of galaxies. They are the largest gravitationally bound objects in the universe, containing thousands of galaxies that are held together by dark matter. The space between galaxies is filled with a very diffuse gas, the so-called “intracluster medium.”

This gas is so hot that it radiates in X-rays but is undetectable at visual wavelengths. Su and her colleagues use space-based telescopes to observe galaxy clusters since the Earth's atmosphere absorbs X-rays. [Read more.](#)



Professor Su and her young daughter

Congratulations to Our Students Who Earned PhDs in the 2019–20 Academic Year!

Alina Aleksandrova: “Magnetic Field Monitoring in the SNS Neutron Electric Dipole Moment Experiment” (Plaster) – now a post-doc at Cal Tech

Armin Ansary: “Scanning Probe Measurements on Iridates and Two-Dimensional Materials” (Strachan/Ng) – now a post-doc at UK (with Prof. Gannon)

Mark Broering: “Study of Cell Charging Effects for the Neutron Electric Dipole Moment Experiment at Oak Ridge National Laboratory” (Korsch) – now a post-doc at MIT

Ankur Das: “Graphene in a Uniform Magnetic Field” (Kaul/Murthy) – now a post-doc at Weizmann Institute (Israel)

Nisheeta Desai: “Quantum Phases and Phase Transitions in Designer Spin Models” (Kaul) – now a post-doc at Tata Institute (India)

Barry Farmer: “Effects of Aperiodicity and Frustration on the Magnetic Properties of Artificial Quasicrystals” (DeLong) – now at local start-up company AT-TEK

Javad Farrokhi: “Electronic Properties of Atomically Thin Material Hetero Structures” (Strachan) – now a lecturer at U. Miami

Animik Ghosh: “Large N Fields and Holography” (Das) – now a post-doc at U. Illinois

Subash Nepal: “Sensitivity of Electron-Proton Coincidence Asymmetries and the Electron Energy Spectrum in Neutron β -Decay to Scalar and Tensor Interactions” (Plaster)

Maryam Shahi: “Transverse and Longitudinal Thermal Diffusivity Measurements of Polymer and Small Molecule Organic Semiconductors with Different Techniques” (Brill) – now a post-doc at UK Dept. of Chemical and Materials Engineering (with Prof. Paterson)

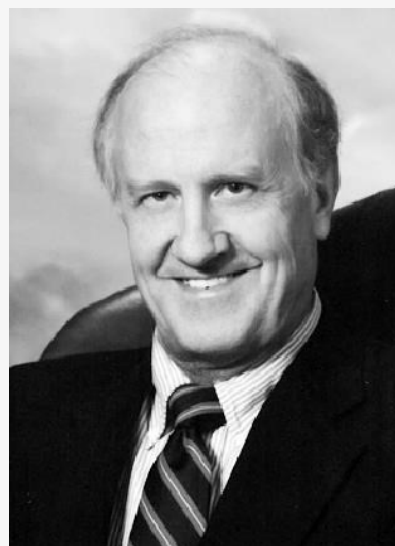
Jun Shi: “Theoretical Studies of C and CP Violation in η to π^+ and π^- to π^0 Decay” (Gardner) – now a post-doc at South China Normal University

Gen Wang: “Lattice QCD Calculation OF Pion Form Factor and Proton Momentum and Angular Momentum Fractions” (Liu) – now a post-doc at UK (with Prof. Liu)

In Memoriam:
Professors Emeriti Fletcher Gabbard & Marcus McEllistrem

Longtime faculty member and department chair **Fletcher Gabbard** passed away in November 2017.

Fletcher was born in Jackson County, Kentucky in 1930 and obtained his B.S degree in physics from U.K. in 1951, after transferring from ECU. Among his favorite teachers at UK was Lewis "Bud" Cochran, who was then still a graduate student but would go on to become a faculty member, dean of the Graduate School and UK vice president, and who was instrumental in bringing the Van de Graaff accelerator to UK.



Fletcher Gabbard (1930–2017)

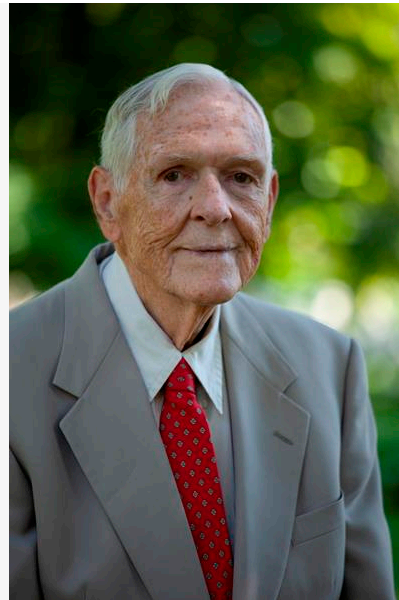
After graduating from UK, Fletcher served in the Army and worked in government laboratories before returning to school and obtaining his Ph.D. at Rice University, where he studied the transmutation of light nuclei under bombardment by neutrons, and where he met his wife, Anne. [Read more.](#)

Emeritus Arts and Sciences Distinguished Professor **Marcus T. McEllistrem** passed away in June 2019. Marcus was born in 1926, in Saint Paul, Minnesota. Marcus and his wife, Eleanor, were married for 62 years and raised six children.

Following his service in the Naval Reserve in World War II, Marcus obtained his B.A. (1950) from St. Thomas College and M.S. (1951) and Ph.D. (1955) in nuclear physics from the University of Wisconsin. After a post-doc appointment at Indiana University, Marcus joined the UK faculty in 1957. He rapidly rose through the ranks to become a professor in 1965, and he remained in this position until his retirement in 1994; however, his research continued until just before his death.

Marcus had a leading role in proposing, designing and constructing the University of Kentucky Accelerator Laboratory (UKAL), and he served as director of the laboratory for its first 35 years.

[Read more.](#)



Marcus McEllistrem (1926–2019)

THE UK PHYSICS & ASTRONOMY DEVELOPMENT FUND

Your gift to the Physics & Astronomy Development Fund will provide critical resources to respond to student needs, attract world-class faculty and provide innovative opportunities to enable our students to compete in the global marketplace. We explore fundamental questions about nature. Undergraduate majors and graduate students take a complete array of courses with small class sizes that span modern topics in physics and astronomy, and they work closely with faculty researchers in studies of nuclear and particle physics, condensed matter and atomic physics and astronomy and astrophysics.

You can support the Physics & Astronomy Development Fund at this [link](#).

If you'd like to give to another fund that is not listed, please use the search box in the upper right of the page and type in the desired fund to make your gift.

By mail, please send to:
UK Philanthropy
P.O. Box 23552
Lexington, Kentucky 40523

For questions please contact Debra Gold at 859-257-8124 or Debra.Gold@uky.edu.



Explore Physics
& Astronomy



Giving and
Support



Contact Us

Department of Physics & Astronomy
177 Chemistry-Physics Building
University of Kentucky
505 Rose Street
Lexington, Kentucky 40506-0055

Phone: (859) 257-6722
Email: Suann.Reese@uky.edu



 University of
Kentucky
College of Arts and Sciences

University of Kentucky College of Arts & Sciences
202 Patterson Office Tower
Lexington KY, 40506-0027

An Equal Opportunity University.

[Preferences](#) | [Unsubscribe](#)