Rochester Academy of Science™

BULLETIN

"An organization of people interested in the Natural Sciences"

April 2025; Vol. 79, #3

President's Message

The Rochester Academy of Science Annual Meeting & Spring Lecture is Tuesday, April 22, 7:00 p.m.

Please join your Academy colleagues for the RAS Annual Meeting and the Spring Lecture on April 22nd at the Rochester Institute of Technology's (R.I.T.) Chester F. Carlson Center for Imaging Science, Room 1125. It will also be available on Zoom. Our meeting will include the election of board members. Details on the meeting and Zoom link is on https://rasny.org/ras-annual-meeting. The ballot and voting instructions are on page 6.

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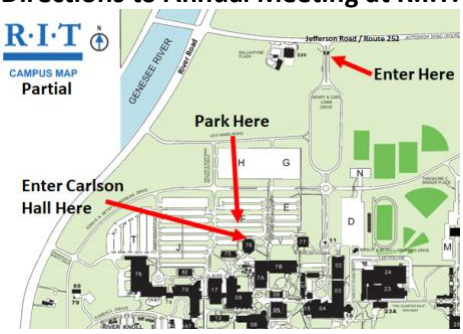
Directions to Annual Meeting at R.I.T.



R.I.T. is southwest of Rochester at One Lomb Memorial Drive, Rochester, NY 14623-5603, off Jefferson Road. Parking is in Lot F. Chester F. Carlson Center for Imaging Science is due south of the parking lot. Room 1125 is an auditorium on the first floor.

* * *

Guest Speaker

Following the short business meeting, our annual Spring Lecture speaker is Dr. Alexander Smith, Associate Professor of Anthropology at SUNY Brockport. He is head of our RAS Anthropology Section. He leads the Frost Town Archaeology project in partnership with the Rochester Museum & Science Center. Frost Town Archaeology is dedicated to the excavation and understanding of this abandoned Euro-American sawmill town, located on what is now the Cumming Nature Center in South Bristol, NY. He will also discuss his excavations of iron-age sites on Mediterranean islands such as Mallorca and Menorca.

Frost Town was one of the region's earliest industrial mill and logging communities. It was settled in the late 18th Century and abandoned when logging ran out and the area moved to agriculture. Since 2019, Frost Town has undergone not only physical changes but in our interpretation.

The area's first water-powered sawmill was built by Revolutionary War veteran Gamaliel Wilder on Briggs Creek a year after he bought the land in 1791. He was familiar with this part on the frontier, having served on the Sullivan Expedition, which invaded Iroquoia with 5,000 men of George Washington's army in 1779. It was chosen not only for its waterpower but also because he knew it had Seneca apple and peach orchards that hadn't been destroyed by Sullivan's army. This 42 square mile lot became the town of South Bristol. There's more at https://frosttownarchaeology.com but the best way to learn is to be at our annual Spring Lecture.

Michael Grenier, RAS President

Notice
All-Academy Annual Business Meeting
7:00 p.m., Tuesday, April 22
R.I.T. Carlson Center Room 1125
& on Zoom, instructions at
https://rasny.org/ras-annual-meeting
Agenda: Welcome, Election, Financial Report, Lecture

Rochester Academy of Science
Free Spring Public Lecture
by Dr. Alexander Smith
State University of New York at Brockport
Associate Professor of Anthropology

Frost Town - Archaeology of a Finger Lakes Ghost Town

Frost Town was an early logging village in South Bristol, New York, established in 1792 and abandoned in the early 1900s. The remains of the site are mostly at RMSC's Cumming Nature Center.

7:30 p.m. ▫ Tuesday, April 22, 2025
RIT Carlson Center for Imaging Science, Room 1125
www.rasny.org for directions
Meeting of Members at 7:00 p.m.

Events for April 2025

April 1 Tues: Fossil Members Meeting

7:00 p.m. – 8:30 p.m. Pittsford Community Center, room 019, 35 Lincoln Avenue Pittsford, NY 14534. Open to all RAS members and guests. Our guest speaker is member Gerry Kloc of the University of Rochester on the latest fossil news from the Paleozoic. He will cover the most interesting developments over the past year or so. Much of this is important news you likely missed because the popular press tends to ignore most of what happened in the Paleozoic. Contact: Dan Krisher DLKFossil@gmail.com or (585) 698-3147.

April 2 Weds: ASRAS Board of Directors Meeting

7:00 pm - 9:00 pm. Members welcome to attend. Contact Tony Golumbeck for details.

April 4 Fri: Astronomy Monthly Meeting

7:30 pm - 9:30 pm
In-person at RIT Carlson Building Room 1125 (simulcast on zoom)
Come as early as 7 pm to socialize. Speaker: Jitrapon Lertprasertpong, RIT Student. Topic: Galaxy Formation and Evolution. Contact Tony Golumbeck at President@rochesterastronomy.org for details.

April 9 Wed: Herbarium

12:00 p.m. - 3:00 p.m. The Life Sciences section will hold a workshop at the RAS Herbarium, located in the basement of the Rochester Museum and Science Center (RMSC). We will be continuing to organize plant specimens in preparation for digitizing the collection. If you plan to attend, please send an RSVP to rasherbarium@gmail.com. At RMSC go to the front desk to meet other participants. For more information, contact herbarium curators, Tim Tatakis and Steven Daniel, by emailing rasherbarium@gmail.com.

April 16 Wed: RAS Board Meeting

7:00 p.m. -9:00 p.m. Pittsford Community Center, room 207, 35 Lincoln Ave, Pittsford. Zoom option available. For details, contact Michael Grenier at mgrenier@frontiernet.net.

April 23 Wed: ASRAS Astronomy Forum

7:30 pm – 9:00 pm. Presenter: Craig Kaplan
Topic: Cool Things to Know about a Hot Object. All are welcome to attend. Contact Craig Kaplan for zoom link.

April 24 Thurs: Life Sciences Section Lecture

7:00 – 8:00 p.m. The Webster Arboretum, 1700 Schlegel Rd, Webster, NY 14580. Open to all RAS members and guests. The speaker is Liz Magnanti, owner of The Bird House in Pittsford, NY. She will be speaking on Orioles and Hummingbirds. These birds spend their winters in Central and South America and migrate back to North America in the spring for breeding season. Learn all about these beautiful birds and how to attract them to your backyard! This is a public lecture and you must register at https://www.thewebsterarboretum.org/events/orioles-and-hummingbirds/form.
Contact: Michael Grenier mgrenier@frontiernet.net or (585) 671-8738 for more information.

April 25 Fri: Astronomy Public Observing

7:30 p.m. – 11:00 p.m. Join us for Public Observing at the Marian and Max Farash Center for Observational Astronomy. All welcome. Members come help visitors look at deep sky objects through our telescopes. Contact Tony Golumbeck at President@rochesterastronomy.org for details.

April 26 Sat: Astronomy Member Observing

7:30 p.m. – 11:00 p.m. Includes the April Messier Marathon. Contact Tony Golumbeck at President@rochesterastronomy.org for details.

April 29 Tues: Mineral Member Hybrid Meeting

7:00 p.m. – 9:00 p.m. Zoom and Pittsford Community Center. Social gathering at 7:00 pm. Presentation at 7:30 pm. Dr. Nick Warner will discuss his latest research related to Mars. Note: Date has been changed due to the RAS Annual Meeting. Members will receive more information in April. Contact: Jutta Dudley, juttasd@aol.com.

STRASENBURGH OBSERVATORY:
ASRAS will operate the telescope at the Strasenburgh Planetarium on mostly clear Saturday nights, dusk until 10:30. For more information, contact: Jim Seidewand at (585) 703-9876.

Featured Article

Understanding Stars: How human knowledge of stars has advanced over time

by Frank Bov

The human race is fascinated by the night sky, points of light whose motion we cataloged long before we understood what stars were. Prehistoric peoples left no written record of their astronomy, beyond the structures they built aligned to the stars. Stone circles like Stonehenge dot the British Isles, dating to 5000 years before present. New World structures like Medicine Wheels, Chaco Canyon, and the Mayan Caracol at Chichen Itza show the same curiosity and wonder, as well as tracking star positions to signal the start of planting season.

Grecian astronomers were the first to leave a written record of what they were thinking. Ancient Greeks used observation as the basis for their universe. Their observations were limited by Iron-age technology, and they felt no shame reverting to beliefs. Expectations of perfection remained. While a Flat Earth could be proven false by looking at a Lunar Eclipse, ideas like an Earth- centered world view and "perfectly" circular orbits, were not easily falsified using Iron-age technology. One problem was obvious – the motion of planets – but even these issues could be accommodated by Ptolemy's "epi-cycles" moving on a circular "deferent."

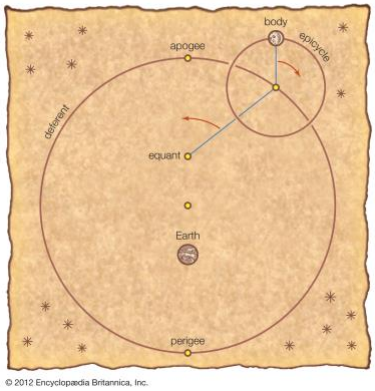


Figure 1: Ptolemaic epicycles

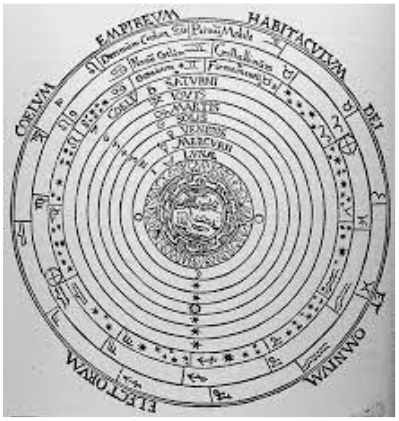


Figure 2: Ptolemaic system

For nearly 2000 years, philosophy dominated science in astronomy, despite clear errors like drift in predicted planetary positions. The Renaissance marked a change in human thought, allowing development of a more-accurate world view.
It took four men, and a hundred years. Copernicus developed the proper sun-centered solar system in the early 1500's, publishing in 1543. Tycho Brahe recorded locations of stars and planets over many decades, convincing himself of the Copernican view. Brahe's research, in the hands of Johannes Kepler, led to the formation of Kepler's Laws of Planetary Motion in 1609.

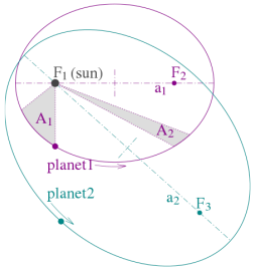


Figure 3: Kepler's Planetary Laws – Equal areas in equal time.

The fourth man was Galileo, whose independent investigations led to the use of optical instruments to observe the heavens, and mathematical relationships to describe the motion of matter.

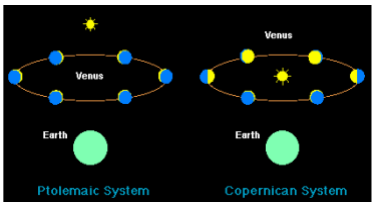


Figure 4: Ptolemaic vs Copernican system

While not its inventor, Galileo is credited with turning the telescope to the skies. His primitive instrument could never resolve stars (no surprise), but it could see that Jupiter and the Galilean Moons were an analog for a sun-centered solar system. It also showed Moon-like crescents for inner planets, Mercury and Venus. More significant was his use of mathematical equations to describe motion, what many consider to be the invention of Physics.

Then Calculus changed everything.

Galileo's laws of motion (distance = velocity x time) were algebraic and empirical. Isaac Newton's Law of Gravity required new mathematics to prove his Force Law ($F = G\ mM/R^2$). In doing so, he introduced a new Aristotelian "perfection" into Nature, physical laws based on fundamental constants, measured properties of matter, and geometry.

The centuries following are characterized by progress; understanding matter enabled better instruments that improved understanding of matter. The physical laws are universal, repeatable, and disprovable by anyone; Science was becoming egalitarian! Physical laws were couched in mathematics, which advanced in parallel. The mathematical "transform" techniques of Laplace, Fourier, et al, were attempts to solve differential equations. These efforts culminated in Maxwell's Equations.

What's that got to do with stars?

Newtonian gravity and Thermodynamics provide a source for a star's energy. Gravity causes matter to clump in one place, accumulating pressure as accretion proceeds. The Ideal Gas Law (pV=nRT) links temperature to pressure.

Planck's Black Body Law links temperature to energy.

Stars shine due to heat from the gravitational pressure of contraction!

But there was a hitch… We had no idea how much energy a star produced. We could measure the power emitted in our direction, but need to know how far away to calculate the total. Enter Joseph Fraunhofer's instruments in the hands of Otto Struve and Friedrich Bessel, and we had our first stellar distance measurement by *parallax*. Parallax provided stellar distances accurate to about 100 parsecs (326 light years), known as Population 1 stars, defining the limit of human knowledge.

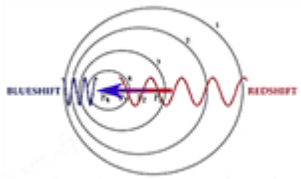


Figure 5: Red-shift Blue-shift due to Doppler effect

Distance was a problem, because stars were so very far away, farther than anyone had thought. The immense distance meant stars were incredibly bright, so bright that the energy of gravitational collapse would not support a long enough life to match observations.

Along came The Atom. Niels Bohr developed a model. Enrico Fermi demonstrated that controlled fission reactions could be used to generate heat. WWII made bombs a priority.

The silver lining of military research is the computer models of H-bombs use the same science as stars. Scientists found that Hydrogen Fusion was the answer to powering stars. Einstein's mass-energy relationship, $E=mc^2$, showed what was possible. Fusion proved more than capable of explaining lifetime stellar energy output.

Modern understanding, based on specific observations, seems complete. Observation of nearby stars gives us examples of all stellar ages: stellar nurseries show young stars contracting and heating up while globular clusters and old open clusters show ordinary stars at end of life. Stars form at a range of size, largest first, smallest (and most numerous) later. Stellar endpoints can be spectacular through mind-blowing (black holes), but even black holes are well understood.

Until we found stars that didn't fit the models as well.

Early models were based on close stars, due to parallax limits, which turned out to be young stars. As instrumentation improved, we found a new kind of star, called Population 2.

They had different spectra, missing many elements found in Pop 1 stars, and were clustered in the "bulge" around the center of the galaxy.

There's an odd wiggle in the spectra of some stars. Doppler shift in spectral lines shows bodies moving toward and away from us, switching direction periodically. The first "wiggles" are understood to come from "spectroscopic" binary stars, too close to split optically. Increasing precision and long-term observation revealed tiny wiggles from even smaller bodies. Optical observation of occulting bodies would confirm them as EXOPLANETS! Initial studies revealed systems no one's theories had predicted. Planets come in many "flavors," but we need better instrumentation to advance the field.

Even "fundamental" concepts are in flux. Expansion of the universe is accepted as fact, but we measure a different expansion rate using a "standard candle" photometric distance method, than by analysis of the Cosmic Microwave Background. Galaxy evolution seems orderly in present times, but what little

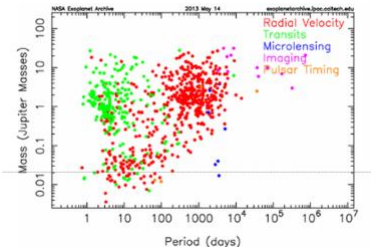


Figure 7: Exoplanet mass vs orbital period

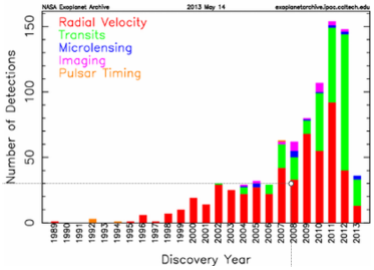


Figure 8: Exoplanet discovery timeline

we know about early galaxies shows them growing immense at very early times, with supermassive black holes at their core, and predicts stars that die in a matter-antimatter explosion.

One lesson of history is that humanity needs increasingly capable instrumentation to advance our understanding of the physical world. A larger instrument with longer wavelength capabilities, located in a very cold spot would do. With the recent commissioning of the James Webb Space Telescope, we can only wonder at the brave new worlds it will reveal.

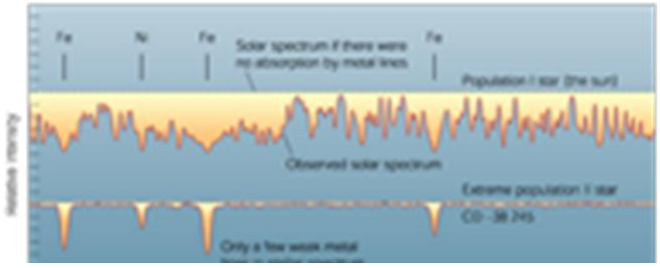
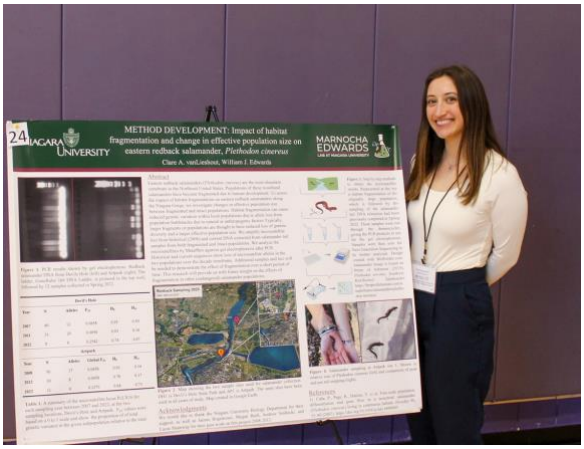


Figure 6. Top: Population I: Many absorption lines also from heavier elements (metals). Bottom: Population II: Absorption lines almost exclusively from hydrogen.

Undergraduate Student Research Grant Awards

These two students presented their projects at the Rochester Academy of Science Fall Paper Session last November at SUNY Brockport. Then they went on to win RAS Student Grant awards for their projects as announced in our February issue.



Clare vanLieshout. Photo credit: Dr. William Edwards.

Impact of habitat fragmentation on the effective population size of Eastern redback salamander, *Plethodon cinereus*

by vanLieshout, C.A., and Edwards, W.J., Niagara University

Abstract:

With habitat fragmentation, local populations can have reduced genetic variation due to allele loss through genetic drift. In practice, this occurs when an originally large population gets split by some natural or anthropogenic barrier, leading to the formation of two smaller populations. Typically, larger fragments or populations are thought to have reduced loss of genetic diversity and larger effective population sizes. Populations of terrestrial salamanders have become fragmented due to human development. To study this effect we are using the Eastern redback salamanders (*Plethodon cinereus*), the most abundant vertebrate in the Northeastern United States. We assessed the effect of habitat fragmentation in these populations along the Niagara Gorge on their effective population size. We used the DNA extracted from salamander tails from historical (2008) and current (2022) samples, collected from a larger, intact population and a smaller fragmented population. Preliminary work showed that historical and current sequences show loss of microsatellite alleles in the two populations after the short, ten year, period. We then expanded on our work by using fragment length analysis of three microsatellite loci. The majority of our samples have a larger expected proportion of heterozygosity (He) than observed heterozygosity (Ho), which indicates reduced genetic diversity in these populations between both historical and contemporary populations at each sample site. The results of our study will provide us with future insight on the effects of fragmentation in other (endangered) salamander populations.

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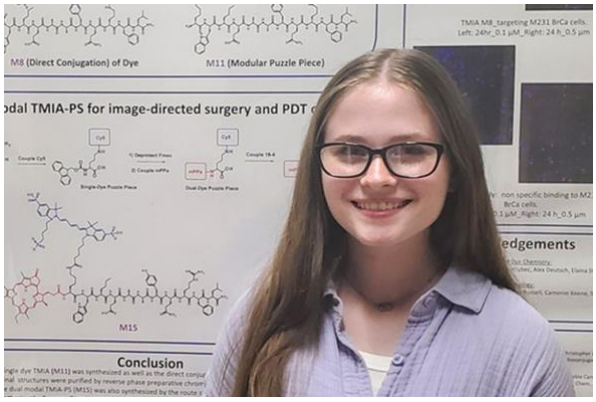


Gabriella Redman. Photo credit: Dr. Hans Schmitthenner.

Near Infrared Probes for Imaging and Photodynamic Therapy for Breast Cancer

by Gabriella Redman, Rochester Institute of Technology.

Abstract:

The aim of our research was to synthesize targeted molecular imaging agents (TMIAs) for the confocal fluorescence microscopy (CFM) of breast cancer (BrCa) cells, as a method of assessing receptor binding. The overall goal involves synthesis of single and dual-dye systems for fluorescence-guided surgery (FGS) and photodynamic therapy (PDT) of BrCa using a near infrared (NIR) dye and a photosensitizer (PS) dye, then coupling to a peptide called 18-4 that targets BrCa cells. This would enable fluorescence-guided surgical lumpectomy operations, followed by the eradication of all cancer cells remaining in the margins by PDT. The synthesis method involves the use of a modular “puzzle piece” to attach Cy5 and Cy5.5, which are NIR dyes with properties ideal for CFM, to the targeting 18-4 peptide. The goal is to show that good binding properties of the probe will lead to an effective agent for combined imaging and therapy of BrCa.

RAS Member Images

Venus near Inferior Conjunction. March 8, 2025; Doug Kostyk. Congratulations to Doug for having this image featured on Spaceweather.com!

Eclipse Composite. March 14, 2025; Nick Paramore

Blood Red Moon with background stars. March 14, 2025; Dick Bennett.

HDR Image of partial eclipse. March 14, 2025; Kevin Lyons.

ROCHESTER ACADEMY OF SCIENCE
BALLOT FOR JUNE 2025 – MAY 2026 OFFICERS

OFFICE	NAME	√	WRITE-IN CANDIDATE
President:	Michael Grenier	☐	
Vice President:	Jeff Gutterman, P.E.	☐	
Treasurer:	Tim Tatakis, Ph.D.	☐	
Secretary:	Helen Downs Haller, Ph.D.	☐	
Member, Board of Directors (2025-2028)	Anthony Golumbeck	☐	
Member, Board of Directors (2025-2028)	Robert Crumrine	☐	

RAS Board of Directors ballot

Please show us your support by printing and mailing your completed ballot to RAS, P.O. Box 92642, Rochester NY 14692-0642. You will also be able to vote at the meeting through the Zoom Chat function. **Note that you must have renewed your membership by March 31st.** We cannot take email ballots.

Rochester Research in Review.

(These are Hot Links which when clicked lead to the press release on the Science Daily and other websites.)

US bird populations continue alarming decline. Cornell University; March 13, 2025

AI ring tracks spelled words in American Sign Language. Cornell University; March 18, 2025

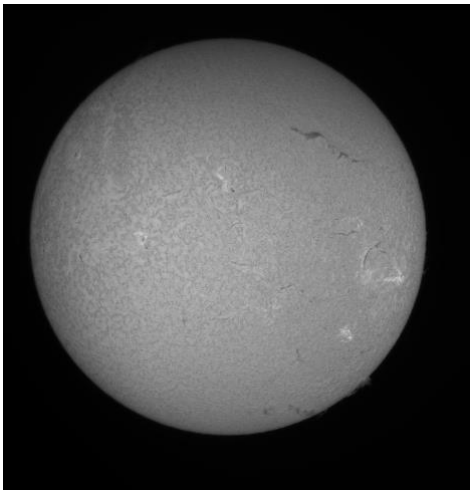
Webb telescope captures its first direct images of carbon dioxide outside solar system. Cornell University co-author; March 17, 2025

New tool enables remote hardware troubleshooting. Cornell University; March 24, 2025

Twisting atomically thin materials could advance quantum computers. University of Rochester; March 17, 2025

Influence of deficit irrigation and biochar amendment on growth, physiology, and yield of cucumber in West Texas. Cornell University; March 20, 2025

Jupiter. March 4, 2025; Kevin Lyons



Sun in H-alpha. March 11, 2025; Eric Day

ABOUT THE ACADEMY

The Rochester Academy of Science™, Inc. is an organization that has been promoting interest in the natural sciences since 1881, with special focus on the western New York state region. Membership is open to anyone with an interest in science. Dues are minimal for the Academy and are listed in the membership application online. Each Section also sets dues to cover Section-related publications and mailings. We are recognized as a 501(c)3 organization.

For information, contact President Michael Grenier at (585) 671-8738 or by email paleo@frontier.com.
The Academy Internet website is http://www.rasny.org or see us on Facebook at https://www.facebook.com/Rochester-Academy-of-Science-792700687474549.

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