The Adolph C. and Mary Sprague
MILLER INSTITUTE
for Basic Research in Science
Newsletter
Spring 2021

Rewinding the Orbital Histories of Satellite Galaxies

Miller Fellow Focus: Ekta Patel

Just as the Moon orbits around the Earth and the Earth orbits around the Sun, some galaxies also orbit around one another. My work focuses on local small galaxies (called satellite galaxies) orbiting around larger, more massive host galaxies. Satellite galaxies are especially important because they directly shape the evolutionary pathways of galaxies like our own Milky Way. Over the course of billions of years, satellite galaxies spiral inwards and eventually merge into their host galaxy, fueling their growth. As a Miller Fellow, I aim to constrain the orbital histories of local satellites galaxies to gain crucial insight on the interplay between satellite galaxies and their host galaxies, which ultimately helps build on our understanding of hierarchical galaxy formation.

Our Milky Way is just one of many galaxies in our galactic neighborhood known as the Local Group. The Local Group also includes Andromeda, our neighboring massive spiral galaxy and the dozens of low mass satellite galaxies orbiting around both the Milky Way and Andromeda. In total, there are approximately 60 known satellite galaxies of the Milky Way and nearly 35 known satellite galaxies around the Andromeda galaxy. However, it was not until very recently that most of these satellite galaxies were discovered. **Figure 1** (page 6) shows the discovery timeline of satellite galaxies around the Milky Way, highlighting that the number of known Milky Way satellites prior to the year 2000 was only about a dozen, but then doubled between 2000-2010 and doubled again between 2010-2020!

Some of most recently discovered satellite galaxies, the "ultra-faint dwarf galaxies," only have stellar masses between 100-100,000 times the mass of the Sun and are thought to be fossils of the first galaxies to form in the Universe. For comparison, the stellar mass of the Milky Way is about ten times higher and the total mass of the Milky Way, including all of the stars, gas, dust, and invisible dark matter amount to nearly one trillion times the mass of the Sun. Theoretical predictions suggest that the Milky Way could host in excess

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Call for Nominations

Visiting Miller Professorship Departmental Nominations
Deadline: September 3, 2021

Miller Research Fellowship Nominations
Deadline: September 10, 2021

Miller Research Professorship Applications
Deadline: September 14, 2021

"The experience [as a Miller Professor] of being amongst postdoctoral researchers, faculty colleagues from across campus, and visiting professors who are all asking and answering fundamental questions has reminded me of the joy of pure inquiry and the excitement of pursuing the unknown, partially insulated from the normal day-to-day constraints of faculty life. I am grateful to the Miller Institute, the staff, and the Miller community as a whole for the lasting impact that my Miller Professorship has had on me and my lab."

- Dan Fletcher

Miller Professor 2019-2020
Bioengineering, UC Berkeley
Faculty Scientist, Lawrence Berkeley National Laboratory
Investigator, Chan-Zuckerberg Biohub

Call for Visiting Miller Professor Nominations

Online Nomination Deadline: September 3, 2021

Visiting Miller Research Professorship AY 2022-2023

The Advisory Board of the Miller Institute for Basic Research in Science invites Berkeley faculty to submit online departmental nominations for Visiting Miller Research Professorships and the Gabor A. and Judith K. Somorjai Visiting Miller Professorship Award for terms in Fall 2022 or Spring 2023. The purpose of these Visiting Miller Professorships is to bring promising or eminent scientists to the Berkeley campus on a short-term basis for collaborative research interactions. It is required that awardees be in residence at Berkeley during their appointment term. Faculty members or research scientists from around the world are eligible to be considered for sponsorship. Non-US citizens must be eligible for J-1 Scholar visa status in order to be awarded. Faculty members at other UC campuses are eligible to be nominated for this program. The Miller Institute, as the sponsor and administrative department, will extend an invitation after advising the department of its selection.

Beginning in June 2021, nominations will be accepted from UC Berkeley faculty for Visiting Professorship candidates for the 2022-2023 academic year. Nominations are judged competitively and are due by September 3, 2021. It is anticipated that between four and ten awards will be made.

For more information, and to access the nomination form, visit miller.berkeley.edu/visiting-professorship.

Call for Miller Professor Applications

Online Application Deadline: September 14, 2021

Miller Research Professorship AY 2022-2023

The Miller Professorship program is looking with a view to the future in announcing the call for applications for terms in the academic year 2022-2023. The objective of the Miller Professorship program is to provide opportunities for faculty to pursue new research directions on the Berkeley campus and to participate in the vibrant Miller Institute interdisciplinary scientific community. Appointees are encouraged to follow promising leads that may develop in the course of their research. In order to accommodate a range of faculty members, the Miller Professorship program offers appointees, in consultation with their Departmental Chair, the option of taking teaching relief or continuing to teach during their Miller Professorship term. Funds will be distributed differently depending upon the choice selected.

The primary evaluation criteria will continue to be research excellence. Proposals to write books are not viewed as competitive. Applicants are also encouraged to describe their interest in participating in the Miller Institute community and providing mentorship to the Miller Research Fellows.

Beginning in June 2021, applications will be accepted from UC Berkeley faculty for terms in the 2022-2023 academic year. Applications are judged competitively and are due by September 14, 2021. It is anticipated that between four and ten awards will be made.

For more information, and to access the application, visit miller.berkeley.edu/professorship.

:: **Nomination & Application details**: miller.berkeley.edu

:: **Questions?** millerinstitute@berkeley.edu

Call for Nominations: Miller Research Fellowship

2022-2025 Term

Nomination Deadline: September 10, 2021

The Miller Institute for Basic Research in Science invites department chairs, faculty advisors, professors and research scientists at institutions around the world to submit nominations for Miller Research Fellowships in the basic sciences. Through this program, the Miller Institute seeks to discover and encourage individuals of outstanding talent, and to provide them with the opportunity to pursue their research on the Berkeley campus. Fellows are selected on the basis of their academic achievement and the promise of their scientific research. Miller Fellows also have a keen curiosity about all science and share an appreciation for an interdisciplinary experience. The Miller Institute is the administrative home department for each Miller Fellow who is hosted by an academic department on the Berkeley campus. A list of current and former Miller Research Fellows can be found at: https://miller.berkeley.edu/fellowship/members/all-mf-by-name.

The Miller Institute also welcomes nominations for the Kathryn A. Day Miller Postdoctoral Fellowship award for the 2022-2025 Fellowship cohort. Named in honor of the Institute's retired Chief Administrative Officer Kathy Day, this award is intended for an early career scientist who, in addition to excelling in their pursuit of basic science research, also engages in outreach in support of science.

Miller Research Fellowships are intended for exceptional young scientists of great promise who have recently been awarded, or who are about to be awarded, the doctoral degree. Miller Fellows are expected to begin their Fellowship shortly after being awarded their Ph.D. A short period as a postdoctoral fellow elsewhere does not exclude eligibility, but applicants who have already completed more than two years of postdoctoral experience are not eligible for nomination. **A nominee cannot hold a paid or unpaid position on the Berkeley campus at the time of nomination or throughout the competition and award cycle which may extend into February 2022.** Nominees who are non-US citizens must show eligibility for obtaining J-1 Scholar visa status for the duration of the Miller Fellowship. Non-US citizens will be required to prove English language proficiency prior to award. The Miller Institute does not support H1B visa status. Eligible nominees will be invited by email by the Institute to apply for the Fellowship after the nomination has been reviewed. Direct applications and self-nominations are not accepted. All nominations must be submitted using the online nomination system at: **miller.berkeley.edu/fellowship.**

Nominators will need the following required information to complete the online nomination process:

- Nominee's complete full and legal name (do not use nicknames)
- Nominee's current institution
- Nominee's complete, current, and active E-mail address that will be valid through March 2022, current mailing address with postal code and telephone number
- Nominee's Ph.D. Institution and (expected) Date of Ph.D. (month & year required)
- Letter of recommendation and judgment of nominee's promise by the nominator (saved in PDF format). Letter must be specific to the Miller Fellowship, have a current date, and be on institutional letterhead. The Executive Committee finds it helpful in the recommendation letter to have the candidate compared with others at a similar stage in their development.
- Nominator's current active E-mail address, title, and professional mailing address (include zip code/campus mail code)

The Institute provides a stipend of $68,000 with annual 2% increases and an annual research fund of $10,000, for total initial compensation of $78,000. There is provision for travel to Berkeley for incoming Miller Fellows and their immediate families and a maximum allowance of $3,000 for moving personal belongings. Benefits, including medical, dental, vision and life insurance are provided with a modest contribution from the Miller Fellow. All University of California postdocs are represented by the UAW. Fellowships are awarded for three years, generally beginning August 1, 2022 and ending July 31, 2025. Approximately eight to ten Fellowships are awarded each year. Candidates will be notified of the results of the competition starting in mid-December, and a general announcement of the awards will be made in the spring.

We are grateful for your thoughtful participation in this process and the contribution you are making in the careers of distinguished early-career researchers.

:: **Nomination & Application details**: miller.berkeley.edu

:: **Questions?** millerinstitute@berkeley.edu

Miller Research Fellowship Awardees 2021-2024

The Miller Institute is pleased to introduce the 2021-2024 Miller Research Fellows. Each year, the Miller Research Fellowship program seeks to discover individuals of outstanding talent and to bring early-career scholars of great promise to the Berkeley campus. The Fellows will be working with Berkeley faculty hosts for a three-year term beginning in the 2021 academic year. A full list of all past and present Miller Fellows is available on our website.

Iwnetim Abate

Ph.D. - Stanford
Berkeley Dept. - Materials Science and Engineering / Chemistry
Faculty Hosts: Kwabena Bediako, Mark Asta, Alessandra Lanzara

Ion-insertion in layered materials has transformed our lives by enabling the invention of Li-ion batteries, which made portable devices and electrification of transportation possible. My research interest lies at the intersection of materials chemistry, surface engineering and electrochemistry to reimagine the physics of ion-insertion towards achieving exquisite atomic level control of material properties and developing novel systems for tunable catalysis, multiplex sensors and quantum information applications.

Anna Barth

Ph.D. - Columbia
Berkeley Dept. - Earth and Planetary Science
Faculty Host: Michael Manga

I study volcanoes and geysers, with a focus on understanding subsurface fluid processes and their relationship to eruption intensity. Since these processes occur deep below the ground, hidden from direct observation, a core aspect of my work is learning how to relate observations at the surface to processes at depth. So far, my approach has involved a range of techniques including field work, laboratory experiments, geochemical analyses, and modeling. Going forwards, I'm excited to extend my observational tools to the vast range of volcano and geyser monitoring data, and to develop ways to represent and integrate these complex and often noisy datasets through methods in data sonification, visualisation, and machine learning.

Michael Celentano

Ph.D. - Stanford
Berkeley Dept. - Statistics
Faculty Host: Martin Wainwright

My research focuses on developing methodology for estimation and inference in high-dimensional regression models. I leverage tools from statistical physics and Gaussian process theory to precisely characterize the behavior of existing methods and to inspire the development of new ones. I am mostly interested in high-dimensional problems which are very noisy and in which signals are structured but relatively weak. In these problems, existing theory often provides limited guidance, and achieving valid, powerful, and computationally tractable inference is difficult but not impossible.

Dimitrios Fraggedakis

Ph.D. - MIT
Berkeley Dept. - Chemical and Biomolecular Engineering
Faculty Hosts: Bryan McCloskey, Kranthi K. Mandadapu

Most biological and electrochemical systems are characterized by disorder at multiple scales, and understanding its influence on electrochemistry and transport is essential to both engineering applications and biological sciences. Disorder is known to give rise to exotic phenomena (e.g., metal-to-insulator transition, superconductivity); however, its effect on electrochemical systems is mostly unexplored.

As a Miller Fellow, my goal is to understand the fundamentals and impact of topological, structural and chemical disorder on electrochemistry and transport. By combining my expertise on theoretical electrochemistry and transport phenomena with simulations and experiments, I plan to develop our fundamental understanding on the effects of disorder in the context of important biological (e.g., signaling, membrane formation) and electrochemical (e.g., CO2 capture, purification, electrocrystallization) applications.

Shashank Gandhi

Ph.D. - California Institute of Technology
Berkeley Dept. - Molecular and Cell Biology
Faculty Hosts: Richard Harland, Megan Martik

In humans, the heart is the first functional organ to form, beginning as a tube that beats and circulates blood, followed by rearrangements that transform the single-chambered tube into a four-chambered organ. Genetic errors in this intricate process can lead to severe congenital heart defects, which are the most common birth defects in humans. Several of these defects result from abnormalities in an embryonic stem cell population called the neural crest.

During my Ph.D. studies at Caltech in Dr. Marianne Bronner's lab, I developed and used cutting-edge genomic tools to investigate the mechanisms driving neural crest formation in the vertebrate embryo. As a Miller Fellow, I will employ a multi-modal approach towards uncovering the genetic circuitry that controls neural crest differentiation into muscular tissue of the heart, focusing on the evolution, septation, and morphogenesis of the outflow tract.

Aaron Joiner

Ph.D. - Cornell
Berkeley Dept. - Molecular and Cell Biology
Faculty Host: James Hurley

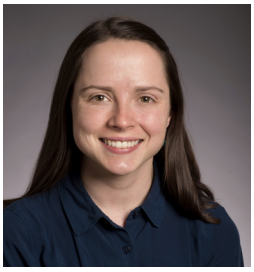
My research interests lie at the intersection of cell homeostasis, membrane biology, and the regulation of cellular trafficking events, with particular focus on the structure and function of key protein components at membrane surfaces. During my PhD, I used X-ray crystallography and cryo-electron microscopy to study two small GTPases and their activators in the early secretory pathway. As a postdoc at UC Berkeley, I will employ cryoEM and other functional approaches to understand the regulation of another small GTPase and its inactivator at the lysosome.

Andrew Rosen

Ph.D. - Northwestern
Berkeley Dept. - Materials Science and Engineering / Chemistry
Faculty Hosts: Kristin Persson, Omar Yaghi

The conventional approach to discovering new materials has largely relied on intuition combined with trial-and-error experimental testing; however, many of the most pressing energy-related problems facing society remain unsolved precisely because they rely on discoveries beyond the boundaries of our current scientific understanding. My research is primarily focused on the use of quantum-chemical simulations and machine learning to transform what has historically been an empirical approach to materials design into one of automated, computationally driven discovery. By bringing recent advances in theoretical chemistry and data science to the intersection of chemical engineering, materials science, and inorganic chemistry, my research aims to accelerate the discovery of novel materials that can address longstanding global challenges in clean energy and sustainability.

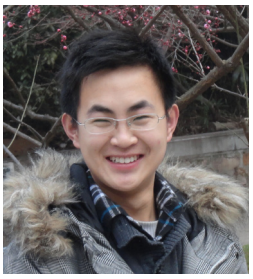
Ellen Vitercik



Ph.D. - Carnegie Mellon
Berkeley Dept. - Electrical Engineering and Computer Sciences
Faculty Host: Michael Jordan, Jennifer Chayes

My research lies at the intersection of artificial intelligence, algorithm design, and economics, with a particular focus on the theoretical underpinnings of these subjects. I am interested in how machine learning can transform the way we design algorithms in computer science and mechanisms in economics, as well as the broader societal impacts of using machine learning in the context of economics.

Yao Yang

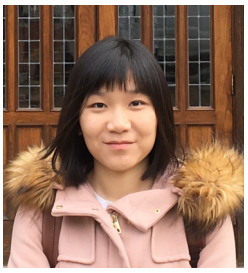


Ph.D. - Cornell
Berkeley Dept. - Chemistry
Faculty Host: Peidong Yang

Electrochemistry lies at the interface between chemistry and physics and represents one of the most promising approaches for enhancing energy efficiency, mitigating environmental impacts and carbon emissions, and enabling renewable energy technologies, such as fuel cells, CO2 and N2 reduction, water splitting and secondary batteries. One of the key challenges in electrochemistry is understanding how to achieve and sustain electrocatalytic activity, under operating conditions, for extended time periods and with optimal activity and selectivity, which calls for the use of *operando/in situ* methods.

During my PhD at Cornell, I worked with Profs. Héctor Abruña, David Muller and Francis DiSalvo in the design of precious-metal-free electrocatalysts for alkaline fuel cells and the characterization and understanding of their reaction mechanisms employing operando transmission electron microscopy (TEM) and X-ray methods. As a Miller fellow, I will work with Prof. Peidong Yang to tackle the fundamental challenges in CO2 reduction to liquid fuels at gas-solid-liquid interfaces in an effort to provide an atomic/molecular-level picture of dynamic electrocatalytic processes with advanced TEM at the LBNL and synchrotron X-ray at the ALS.

Yi Zhang



Ph.D. - Princeton
Berkeley Dept. - Earth and Planetary Science
Faculty Host: William Boos

I am interested in how the Earth's climate system works with a focus on the dynamics of the tropical atmosphere. I seek to explain the patterns of convection, rainfall, radiative fluxes using a combination of theory, modeling, and observations. I am also interested in how these processes would evolve in response to climate change.

NEXT STEPS

Alison Feder (Miller Fellow 2018-2021) will join the Genome Sciences Department at the University of Washington as an Assistant Professor.

Daniel E. Ibarra (Miller Fellow 2019-2021) will join Brown University as an Assistant Professor in the Department of Earth, Environmental and Planetary Sciences and a Fellow at the Institute at Brown for Environment & Society.

Georgios Moschidis (Miller Fellow 2018-2021) will join Princeton University as a Clay Research Fellow.

Soonwon Choi (Miller Fellow 2018-2021) will join the MIT Department of Physics as an Assistant Professor.

> CONTINUED FROM PAGE 1 [Miller Fellow Focus]

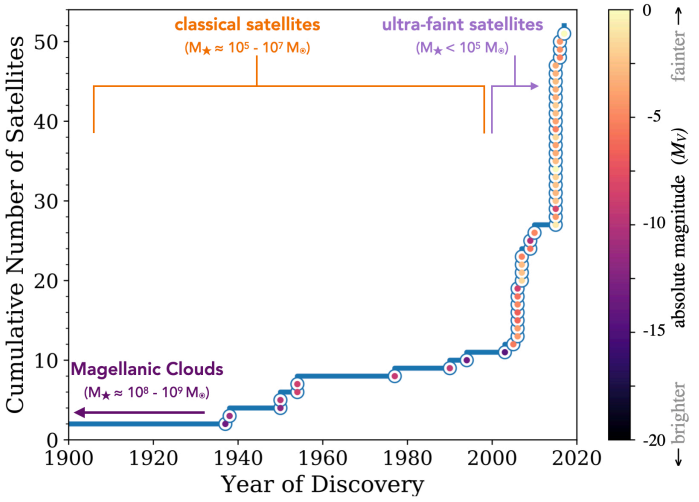


Figure 1: Discovery timeline of Milky Way satellite galaxies. The Magellanic Clouds are the brightest, most massive Milky Way satellites. The first mentions of the Clouds in written literature date back to the 10th century. Symbols represent each new satellite discovery and are colored by their absolute magnitude, a measure of their brightness or luminosity. A difference of five magnitudes is equivalent to a factor of 100 in the luminosity. The advent of digital sky surveys, such as the Sloan Digital Sky Survey and the Dark Energy Survey, have led to the sharp increase in discoveries post-2000. The stellar masses of satellites are listed by category and in units of solar masses. There are currently about 60 known satellite galaxies around the Milky Way.

of 200 satellite galaxies, thus the search for satellite galaxies is not yet complete. Upcoming surveys such as the Legacy Survey of Space and Time (LSST) conducted by the Vera C. Rubin Observatory will be key to bridging the gap between observations and predictions.

In addition to knowing some of the internal properties of satellite galaxies in the Local Group, such as how quickly the stars are rotating and how much cold gas remains to fuel new star formation, three-dimensional (3D) motions of satellite galaxies have also been measured. Thanks to space observatories such as the *Hubble Space Telescope* and the *Gaia* spacecraft, full 6D phase space information (3D position and 3D velocity) is now available for more than 80% of the Milky Way's satellite galaxies, making it possible to rewind the orbits of satellite galaxies backwards in time. This phase space information primarily relies on a quantity called proper motion, the rate of motion in the plane of the sky over a given period of time. This is so challenging to measure that measuring the proper motion of the Andromeda galaxy with *Hubble* is compared to watching human hair grow at the distance of the Moon! Nevertheless, proper motion measurements unlock an entirely new parameter with which we can now reconstruct the dynamical history for more than half of the galaxies within the Local Group.

As a part of my Ph.D. thesis with Dr. Gurtina Besla, I studied the orbital evolution of the most massive satellite galaxies in the Local Group: the Large and Small Magellanic Clouds around the Milky Way and Triangulum (also known as M33) around Andromeda. These satellites weigh at least 10% of the mass of their host galaxies, thus interactions between these massive satellites and their host galaxies are even more impactful than those of their low mass counterparts. In particular, I aimed to understand what type of orbital history was most plausible for M33 relative to Andromeda, given the measured phase space of both galaxies. We found that M33 is likely on its first passage around Andromeda, only having arrived at its closest position relative to Andromeda at its location today. This is in contrast to previously published results, which suggested that M33 and Andromeda passed nearby one another in the last few billion years, leading to the formation of some irregular warp-like structures in the outer stellar and gaseous disks of M33. However, our results show that this solution is very statistically rare and that there must be some other phenomenon that could explain the existence of such structures.

Our hypothesis is that M33 hosts its own population of satellite galaxies that may have distorted the outer regions of M33's stellar and gaseous disks via interactions and previous mergers. Currently, I am leading a collaboration to hunt for these potential *satellites of a satellite galaxy*!

During my time as a Miller Fellow, I have also been interested in identifying satellite galaxies around the Magellanic Clouds. They too are expected to host a population of their own satellite galaxies, and with recently measured 6D phase space information from the Gaia spacecraft, we were able to compute thousands of potential orbital histories to determine which ultra-faint dwarf galaxies are true dynamical companions of the Clouds. We found that six satellite galaxies have been orbiting around the Clouds over the last few billion years as the entire system of eight galaxies enters and passes through the halo of the Milky Way. **Figure 2** (next page) illustrates the orbits of these Magellanic satellites in blue, along with the orbits of other Milky Way satellite galaxies located throughout the Milky Way's dark matter halo (gray sphere, **Figure 2**).

Another aspect of my work focuses on how the collective phase space information of satellite galaxies can help us estimate the properties of the host galaxies they orbit around. As satellite galaxies trace out the extents of the invisible dark matter reservoir surrounding their host galaxies (see **Figure 2**), the dynamical properties (i.e., orbital angular momentum) of satellite galaxies can help to statistically constrain the total mass of galaxies like the Milky Way and Andromeda when combined with satellite galaxy analogs from simulations. During my Ph.D., I developed the methodology for this statistical analysis and published first results. Currently, I am working to extend this method to a population of four satellite galaxies around Andromeda, the only Andromeda satellites for which

we have measured phase space information, to estimate the most precise mass estimate for the Andromeda galaxy to date. With my faculty host, Dr. Daniel Weisz and collaborators, we will obtain 6D phase space information for all of Andromeda's satellite galaxies over the next decade, allowing us to improve our estimates even further.

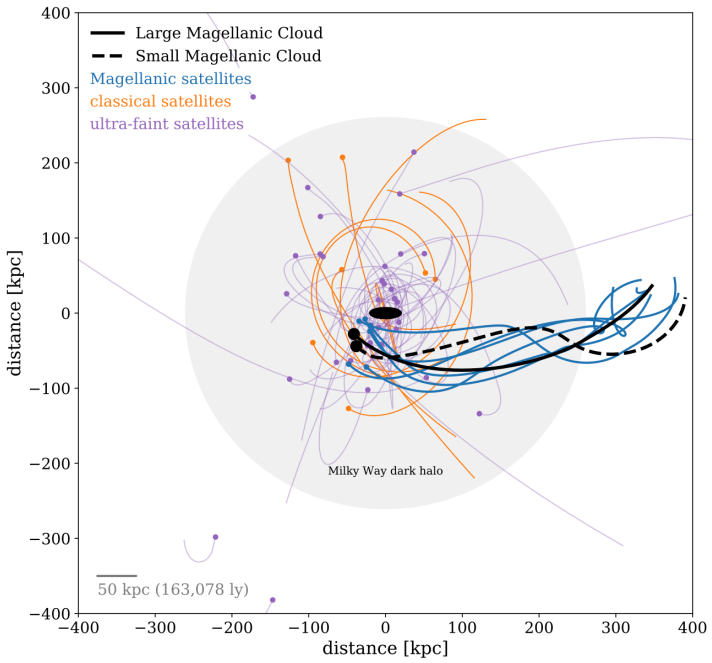


Figure 2: The orbits of Milky Way satellite galaxies over the last 3 billion years. Circular symbols indicate where satellites are located today while curves represent the backwards trajectories of satellite galaxies. Distances are provided in kiloparsecs, abbreviated as kpc (50 kpc = 163,078 lightyears). The dark matter halo of the Milky Way is approximated by the gray sphere. Orbits of the Large and Small Magellanic Clouds are indicated with solid and dashed black lines, respectively. The orbits of the classical satellites are indicated in orange and the ultra-faint dwarfs' orbits are in purple (see **Figure 1**). The group of ultra-faint satellite galaxies identified to be companions of the Magellanic Clouds (Carina 2, Carina 3, Horologium 1, Hydrus 1, Phoenix 2, and Reticulum 2) are in blue. These satellites clearly evidence a shared orbital history with the Clouds over the last 3 billion years and have entered the dark matter halo of the Milky Way as a group.

Ekta Patel grew up in the small, urban city of Bayonne, NJ and received her B.A. in Physics from New York University. After spending four years in bustling Manhattan, Ekta moved to the Sonoran Desert town of Tucson, Arizona to pursue her Ph.D. in Astronomy & Astrophysics under the supervision of Dr. Gurtina Besla. In fall 2019, Ekta started as a Miller Fellow, hosted by Dr. Daniel Weisz in the Astronomy Department. She has continued her work in near-field cosmology and also enjoys communicating science to diverse audiences. During the weekends, Ekta enjoys spending time with her dog and husband, baking, hiking, and enjoying the beautiful Bay Area weather. Ekta is also a member of the Miller Institute's Diversity, Equity, Inclusion, and Belonging Working Group.

Contact: ektapatel@berkeley.edu
Website: https://www.ektapatelastro.com

IN THE NEWS

Michael Manga (Miller Fellow 1994-1996, Miller Professor 2008-2009, Executive Committee Member 2009-2012, Executive Director 2010-2016, Symposium Chair 2018-Present) is a co-author of the paper "Brittle fragmentation by rapid gas separation in a Hawaiian fountain" published in *Nature Geoscience*.

Chung-Pei Ma (Miller Professor 2010 and 2019-2020) leads the MASSIVE survey of local galaxies, which provided data for 43 of the galaxies — two-thirds of those employed in the new analysis, using a relatively new and potentially more precise technique for measuring cosmic distances, which employs the average stellar brightness within giant elliptical galaxies as a rung on the distance ladder.

Dan Ibarra (Miller Fellow 2019-2021) helped co-found the **Asian Americans and Pacific Islanders (AAPI)** in Geoscience group. Both he and **James Olzmann** (Miller Professor 2020-2021) were nominated and recently elected as full members to **The Philippine-American Academy of Science and Engineering (PAASE)** this year.

Kirk Lohmueller (Miller Fellow 2010-2013) is a co-author of a paper "Negative selection on complex traits limits phenotype prediction accuracy between populations" published in *AJHG (The American Journal of Human Genetics: Cell Press)*.

Greg Engel (Miller Fellow 2005-2008) is a senior author on the study of a microorganism called green sulfur bacteria. Scientists found that a species of bacteria called C. tepidum employs the laws of quantum mechanics to protect itself from oxygen damage.

Paul Alivisatos (Miller Professor 2001-2002) was named the next President of **The University of Chicago.**

Rebekah Dawson (Miller Fellow 2013-2015) was awarded the **2021 Helen B. Warner Prize for Astronomy** by the American Astronomical Society (AAS).

New observations led by astronomer **Imke de Pater** (Miller Professor 1993, 2003-2004) confirm volcanic contribution to the atmosphere of Jupiter's moon Io.

Dan Nicolau's (Miller Fellow 2008-2011) recent publication in *The Lancet Respiratory Medicine* examines the use of corticosteriods in protecting from and treating COVID-19.

Benjamin Good (Miller Fellow 2016-2019) was awarded a **2021 Sloan Research Fellowship in Computational & Evolutionary Molecular Biology.**

Yi Cui (Miller Fellow 2003-2005) was recently appointed as the Director of **Precourt Institute for Energy**, overseeing all the energy-related activity at Stanford.

Alex Filippenko (Miller Senior Fellow 2017-Present) was named a **2021 AAS Fellow**.

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Miller Institute News - Spring 2021
Please send address corrections to:
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WELCOME TO OUR NEW EXECUTIVE COMMITTEE AND ADVISORY BOARD MEMBERS

Welcoming new Executive Committee member Professor Chung-Pei Ma!

Chung-Pei Ma is returning to the Miller community after two terms as a Miller Professor (2010, 2019-2020). Chung-Pei is the Judy Chandler Webb Professor in Physical Sciences and a Professor in Astronomy and Physics. She is an astrophysicist who enjoys using luminous matter to study dark components in the universe: dark matter, dark energy, and black holes. Her research group uses both theoretical and observational tools to investigate the cosmic assembly of black holes and galaxies. She is an avid violin player and dreams about being able to perform all Beethoven string quartets one day.

Welcoming new Advisory Board member Professor Scott Edwards!

Scott Edwards is the Alexander Agassiz Professor of Zoology and Curator of Ornithology in the Museum of Comparative Zoology at Harvard University. Scott is an evolutionary biologist, with diverse interests in molecular evolution, phylogenetics, comparative genomics and population genetics. His research uses birds as model systems, focusing on their evolutionary history and genome evolution, and fieldwork across the globe. He has a long-standing interest in increasing the diversity of undergraduates, graduate students and faculty in evolutionary biology and biodiversity science.

THANK YOU TO OUR OUTGOING EXECUTIVE COMMITTEE AND ADVISORY BOARD MEMBERS

The Miller Institute gratefully acknowledges the dedicated service of **Professor Steve Leone** who served on the Executive Committee (2015-2021) and to **Professor Steve Block** (Stanford) who served on the Advisory Board (2015-2021). Their leadership and guidance over the years have been appreciated beyond measure.

Professors Steve Leone and Steve Block are pictured on the leftmost side of each of the following photos.