

Electronic Newsletter

December 15, 2016

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Daniel Kasen
Member-at-Large:
Marc Kamionkowski
Member-at-Large:
Tracy Slatyer

Questions? Comments?

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Keivan Stassun
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Finalize your plans now to attend the April 2017 meeting held this year in **January** in Washington, DC. A number of plenary and invited sessions will feature presentations by DAP members. Here are the key details:

What: April 2017 APS Meeting

When: Saturday, Jan 28 – Tuesday, Jan 31, 2016

Where: Washington, DC (Marriott Wardman Park)

Registration Deadline: January 6, 2017

The 2017 April Meeting will take place at the Marriott Wardman Park. Detailed information for the meeting, including details on registration and the scientific program can be found online at <http://www.aps.org/meetings/april>

Note that you can still register on-site, if you don't do so by the deadline.
Registration fees range from \$30 for undergraduates to \$480 for full members.

Nominations for the APS DAP Executive Committee Officers

Deadline: December 21, 2016

Each year the Division of Astrophysics (DAP) of the APS elects new members for the open positions on the DAP Executive Committee. The members of the DAP Executive Committee serve to address the needs and interests of the Division within the APS. The Executive Committee has responsibility for the planning and organization of all Division activities and business including detailed program planning for each annual April APS meeting.

A nominating committee is being appointed by the current executive Committee and by the APS. DAP members are also invited to suggest candidates for consideration. Please relay the names of suggested candidates to the DAP Secretary-Treasurer, Keivan Stassun (keivan.stassun@vanderbilt.edu) by December 21, 2016.

The Division of Astrophysics (DAP) will be holding elections to fill vacancies for four open positions (for the current roster, see <http://www.aps.org/units/dap/governance/officers/>). Those positions are:

- **Vice-Chair.** Term of Office: one year, followed sequentially by one year of service as Chair-Elect, and then one year as Chair, and then finally one year as Past Chair (four years total, serving as a member of the Executive Committee through April, 2021). Duties: The Chair shall convene and preside at all meetings of the Executive Committee and business sessions of the Division. The Chair Elect has primary responsibility for organizing Division program sessions and activities for the annual April APS meeting.
- **Members-At-Large** (two positions). Term of Office: two years starting April 2017. Duties: The Members-At-Large will serve to enable all plans and activities of the Executive Committee, contributing to the planning and organization of Division program and serving on other DAP committees as needed.
- **Deputy Secretary-Treasurer.** Term of office: two years overlapping that of the Secretary-Treasurer; subsequently, he/she will become the Secretary-Treasurer for the following two years. His or her duties will be to assist the Secretary-Treasurer in all tasks of that position. Those include: sending out necessary notices, announcements, and newsletters to the members the Division, and serving as Executive Committee liaison to the APS business office on all matters pertaining to Division finances and disbursements.
- **Divisional Councillor.** Term of office: four years. The DAP Councilor is our representative to and from the APS Council which controls the scientific affairs of the APS. The Councilor is also a candidate for the APS Board (which has fiduciary responsibility for APS) at the end of his/her first year on Council, and for the Council Steering Committee (which sets the agenda for Council) at the end of their 2nd year on Council. It is an opportunity for astrophysicist members of APS to get to know the rest of APS physics and for them to get to know us and why we are APS members.

As in years past, elections will be conducted primarily online. Every DAP member will be notified of the elections and will have online access to the job descriptions and statements for each candidate. Elections will begin in mid-February 2017 and results will be announced by early-April 2017. Watch your email.

The APS DAP Executive Committee strongly encourages Division members to participate in the election. Again, please relay your suggestions for Executive Office Nominations to keivan.stassun@vanderbilt.edu by December 21, 2016. The membership of APS is diverse and global, and the Executive Committee of DAP should reflect that diversity. Nominations of women and members of underrepresented minority groups are especially encouraged.

Elections for the APS DAP Officers

Deadline: March 31, 2017

We urge you to cast your vote in the annual DAP elections for the DAP officers. Please check your e-mailbox in February for the announcement and voting instructions. No lines to stand in; no polling places closing on you; simply spend 5 minutes perusing the superb qualifications of the candidates and a few more seconds recording your vote. You have a full 7 days to fill out the ballot.

2016 APS Fellows

Please join the DAP Executive Committee in congratulating the 2016 American Physical Society Fellows who are members of the Division of Astrophysics:

- **Bean, Rachel** (Cornell University): For contributions to the understanding of dark energy, and her cosmological observations to constrain physics beyond the Standard Model of physics.
- **Bell, Nicole** (University of Melbourne): For fundamental contributions regarding the interface of astrophysics and particle physics, particularly in neutrino astrophysics and cosmology, and dark matter phenomenology.
- **Chung, Daniel** (University of Wisconsin - Madison): For broad contributions to the interface of high energy theory and cosmology.
- **Coutu, Stéphane** (Pennsylvania State University): For his pioneering contributions to particle astrophysics, spanning the energy range from direct measurements to the highest energy particles found in nature.
- **Donahue, Megan** (Michigan State University): For advanced cosmological observations and analyses of galaxy clusters, and of the relationship between the thermodynamic state of circumgalactic gas around massive galaxies, the triggering of active galactic nucleus feedback, and the regulation of star formation in galaxies.
- **Feldman, Hume A.** (University of Kansas): For his contributions to cosmology, particularly cosmological perturbations, the statistical and dynamical properties of the large scale structure of the universe, the innovative treatment of cosmic peculiar velocity fields, and the imposition of constraints on cosmological parameters.
- **Gondolo, Paolo** (University of Utah): For outstanding theoretical contributions to dark matter research, particularly direct and indirect dark matter searches.
- **Hornschemeier, Ann** (NASA Goddard Space Flight Center): For outstanding contributions to the understanding of physics and the evolution of X-ray binaries in other galaxies.
- **Keating, Brian** (University of California, San Diego): For his role in designing the Background Imaging of Cosmic Extragalactic Polarization (BICEP) experiment to search for the unique cosmic microwave background polarization pattern predicted by models of inflationary cosmology, and his founding of the POLARBEAR experiment, which produced the first measurements of both the B-mode power spectrum of the cosmic microwave background, and the detection of the gravitational lensing deflection power spectrum from the cosmic microwave background's polarization.
- **Kelley, Richard L.** (NASA Goddard Space Flight Center): For exceptional contributions to the development of high-resolution cryogenic X-ray spectrometers, and outstanding leadership of Astro-H Soft X-ray Spectrometer team research.
- **Lee, Adrian** (University of California, Berkeley): For original work in developing innovative detector systems and instrumentation to enable increasingly precise observations of the cosmic microwave background.
- **Mostafá, Miguel** (Pennsylvania State University): For participation in the design, development, construction, and operation of the Pierre Auger Observatory and High Altitude Water Cherenkov Observatory, for contribution to the Auger hybrid reconstruction and derived measurements of composition, and for leadership of the Auger analysis group dedicated to the search of the sources of the highest energy cosmic rays.
- **Peiris, Hiranya** (University College London): For significant contributions to the Wilkinson Microwave Anisotropy Probe project, Planck analyses, and the application of advanced statistical techniques to a wide range of astronomical data.
- **Pryke, Clement** (University of Minnesota): For groundbreaking measurement and data analyses of the polarization of cosmic microwave background radiation, and for using the data to provide strong constraints on the composition and initial conditions of the early universe.
- **Stassun, Keivan** (Vanderbilt University): For helping to substantially increase Ph.D. attainment in physics and astronomy for underrepresented minorities, and for fundamental contributions to the astrophysics of young stars and brown dwarfs.

2017 Bethe Prize



Please join the DAP Executive Committee in congratulating **Stuart L. Shapiro**, the 2017 recipient of the DAP-DNP **Hans A. Bethe Prize**. The citation reads:

"For seminal and sustained contributions to understanding physical processes in compact object astrophysics, and advancing numerical relativity."

Encourage your students to join the APS and DAP

The next generation of physicists are current students. The APS has many programs to help students grow their careers. Students can join the APS with the first year free and the low rate of \$35/year thereafter; they can join up to two Divisions and Topical Groups for free. Please see <http://www.aps.org/membership/student.cfm> for details. Once they are members, students are eligible to give talks at APS meetings, apply for travel support and merit-based awards, and more. Student DAP members can apply for up to \$600 in travel support to attend the April Meeting; they can also be nominated to be considered for the Thesis Prize, which includes giving an invited talk with additional travel support.

One of the main goals of the APS is to "advance and diffuse the knowledge of physics." This includes advocacy with the government and the press, connecting different parts of the community, publishing leading journals, running meetings with great opportunities for students, providing professional recognition, and more.

In a similar way, the DAP works to advance and diffuse the knowledge of astrophysics, which includes helping the APS carry out the above missions. Astrophysics is on a great run of important discoveries that impact many fields. We are working to grow the scope of the DAP to better include new developments in cosmology, gravitation, particle and nuclear astrophysics, and more.

Advisors can play a crucial role in encouraging their students to join the APS and DAP. Please forward this to yours!

Overview of the April Meeting (in January!)

We are excited about this April Meeting and hope that you plan to attend. This newsletter includes some highlights and special features of the DAP-related parts of the meeting. Details are given in the following pages. This year DAP is sponsoring **42** sessions at the APS April Meeting, including **10** invited sessions and **7** focus sessions, as well as the DAP Thesis Prize session.

- **Plenary sessions.** There are three plenary sessions at the April meeting. The first, on Saturday morning, taking advantage of the high density of policy makers in the DC area is on *Science Policy in the 21st Century* and will feature talks by John Holdren (OSTP), Cherry Murray (DOE Office of Science), Rush Holt Jr (former congressman, AAAS), Bill Foster (congressman). The Kavli plenary session on Monday morning echos the overall "quarks to cosmos" theme of the meeting, with talks by Barbara Jacak, Cora Dvorkin, and Sylvester Gates. The final plenary session, on Tuesday morning is on Black Holes, with talks by Laura Cadonati, Chung-Pei Ma and Andrew Strominger.

In addition, there will be a public talk by Martin Rees; at the time of this writing the details of that talk are still being finalized.

- **Focus sessions and contributed sessions.** The DAP, in cooperation with several other APS units (DNP, DPF, and DGRAV), is offering a large number of invited sessions covering a wide range of forefront topics and a diverse set of excellent speakers. Each invited session consists of three 36 min talks (including time for questions), so provides an opportunity to learn about compelling topics in our field in a format that allows a description of key result and the surrounding context.

We would especially like to highlight some of our DAP members who are giving prize talks at the April APS meeting. These are *session C15*: Tracy Slatyer (Henry Primakoff prize); *session J15*: Martin Rees (Lilienfeld Prize), Enrico Ramirez-Ruiz (Edward A. Bouchet Award), and Stuart Shapiro (Hans A. Bethe Prize).

- **DAP Focus sessions and contributed sessions.** Focus sessions consist of one invited talk followed by 6 contributed talks. Often these are structured with the invited talk providing an introduction and setting the stage for a topic followed by a sequence of more detailed presentations of various aspects of the results and interpretation. This year the topics range from multimessenger particle astrophysics (session E4), Electromagnetic Follow-up of Gravitational Wave Candidate Events (M3), The Galactic Center Excess (R5) and Gravitational Waves and Dark Matter (U5).

The DAP, in partnership with NASA's Physics of the Cosmos (PCOS) program, organizes sessions to discuss the activities of PCOS and of the various science interest groups within PCOS. These sessions, open to everyone, provide an opportunity to learn about and provide input to the activities of the NASA physics of the cosmos program. These sessions are happening on Sunday, starting with the main PCOS session at 8:30am, followed by Gamma-Ray Science Interest Group (K9), Cosmic-ray Science Interest Group (K4), and Gravitational Waves Science Interest Group (K5) at 1:30pm.

In addition to the invited and focus sessions, there is also a rich menu of DAP contributed sessions. We encourage you to browse through all the DAP sessions by going to the session index of the scientific program and selecting DAP sponsor. (<http://meetings.aps.org/Meeting/APR17/SessionIndex2?SponsorID=DAP>)

- **DAP Reception & Awards Ceremony.** Please join us on Monday evening at 5:30 for the this reception and ceremony (formerly known as the DAP Business Meeting) in Room *Virginia A*, where food and drinks will be served.

- **Focus on Young Scientists.** A cohort for four finalists for the DAP Outstanding Doctoral Thesis Award will give invited talks at a special session on Saturday, January 28 at 3:30pm (Session E15). The finalists are: Anna Patej ("Distributions of Gas and Galaxies from Galaxy Clusters to Larger Scales"), Garrett Somers ("Exploring non-standard stellar physics with lithium depletion"), Morgan MacLeod ("Social Stars: Modeling the Interactive Lives of Stars in Dense Clusters"), and Carlos Arguellas ("The Search for Sterile Neutrinos with IceCube"). The winner will be announced at the DAP Reception & Awards Ceremony, Monday evening. In addition, the DAP is providing travel awards of up to \$600 for approximately 30 graduate students to attend the meeting.

DAP Reception and Awards Ceremony at April (January) 2017 APS Meeting Monday, January 30 at 5:30 PM in Room *Virginia A*

The Division of Astrophysics will hold its annual **Business Meeting** at the April APS meeting in Washington, DC on **Monday, January 30 at 5:30 PM** in Room *Virginia A*. ***All members of DAP are warmly encouraged to attend the annual business meeting, which this year we are re-christening as the Reception & Awards Ceremony.*** Please join us for discussion of issues relevant to the membership of the DAP. Newly elected APS Fellows from the DAP will be honored and the winner of the DAP Thesis Prize will also be announced. Refreshments will be served. See you there!

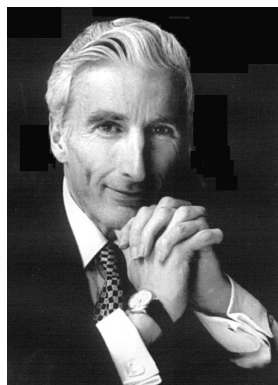


Public Lecture (Session TBD:)

TBD

TBD

Martin Rees, Astronomer Royal, Cambridge University



Plenary Sessions for the April 2017 Meeting

Plenary I (Session A1, Ballroom Salon 2/3): Science Policy in the 21st Century

Saturday, January 28, 8:30 AM

- John Holdren (OSTP)
 - Cherry Murray (DOE Office of Science)
 - Rush Holt Jr (AAAS)
 - Bill Foster (congressman D-IL)
-

Plenary II (Session Q1, Ballroom Salon 2/3): Fred Kavli Plenary Session II: Quarks to the Cosmos

Monday, January 30, 8:30 AM

- Barbara Jacak (UC Berkeley and Lawrence Berkeley National Laboratory) *“Quark Gluon Plasma: Surprises from strongly coupled QCD matter”*
 - Cora Dvorkin (Harvard) *“New Frontiers in Cosmology”*
 - Sylvester Gates (Maryland) *“The 1,358,954,496 Matrix Elements to Get From SUSY Diff EQ’s to Pictures, Codes, Card Games, Music, Computers, and Back Again”*
-

Plenary III (Session W1, Ballroom Salon 2/3): Black Holes

Tuesday, January 31, 8:30 AM

- Laura Cadonati (Georgia Tech) *“Einstein’s Gift: Stellar Mass Black Holes in the LIGO Era”*
 - Chung-Pei Ma (UC Berkeley) *“The Most Massive Black Holes in the Local Universe”*
 - Andrew Strominger (Harvard) *“The Black Hole Information Paradox, Revisited”*
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DAP Focus and Invited Sessions at the April 2017 Meeting

The current schedule of the focus and invited sessions sponsored or co-sponsored by DAP is tabulated in time-order below.

Session ID	Title	Day Date	Start Time	Room
B15	Electromagnetic Signatures of Neutron Star Mergers	Sat. Jan 28	10:45 AM	Washington 2
C10	Indirect Detection of Dark Matter	Sat. Jan 28	1:30 PM	Roosevelt 2
E4	Multimessenger Particle Astrophysics	Sat. Jan 28	3:30 PM	Virginia A
E15	DAP Thesis Prize	Sat. Jan 28	3:30 PM	Washington 2
H5	Physics of the Cosmos	Sun. Jan 29	8:30 AM	Virginia B
H15	Cosmology with Ultra Low Mass Fields	Sun. Jan 29	8:30 AM	Washington 2
J15	Prize Talks: Black Holes and Cosmic Explosions	Sun. Jan 29	10:45 AM	Washington 2
K4	Cosmic-ray Science Interest Group	Sun. Jan 29	1:30 PM	Virginia A
K5	Gravitational Wave Science Interest Group	Sun. Jan 29	1:30 PM	Virginia B
K9	Gamma-ray Science Interest Group	Sun. Jan 29	1:30 PM	Roosevelt 1
K15	SN 1987A: 30 Years Later	Sun. Jan 29	1:30 PM	Washington 2
M3	Electromagnetic Follow-up of Gravitational Wave Candidate Events	Sun. Jan 29	3:30 PM	Maryland C
M16	Neutron Skins, Hypernuclei and Neutron Stars	Sun. Jan 29	3:30 PM	Washington 3
R5	The Galactic Center Excess	Mon. Jan 30	10:45 AM	Virginia B
S4	Progenitors of Merging Binary Black Holes	Mon. Jan 30	1:30 PM	Washington 1
S15	Correlating Optical and CMB Surveys	Mon. Jan 30	1:30 PM	Washington 2
U5	Gravitational Waves and Dark Matter	Mon. Jan 30	3:30 PM	Virginia B
U15	New Results from Galaxy Surveys	Mon. Jan 30	3:30 PM	Washington 2
X15	Dynamics of Planetary Systems	Tue. Jan 31	10:45 AM	Washington 2

Focus Sessions for the April 2017 Meeting

Multimessenger Particle Astrophysics **Saturday, Jan 28, 3:30 PM Session E4, Room Virginia A**

Speakers: Miguel Mostafá, Amy Connolly, Nathan Griffith, Shunsaku Horiuchi, Justin Vandenbroucke, Reshmi Mukherjee, Adam Goldstein, Naoko Kurahashi Neilson, Erik Blaufuss, Nestor Mirabal, Ezequiel Alvarez, Alessandro Cuoco, Gabrijela Zaharijas

Mini-symposium: Physics of the Cosmos **Sunday, Jan 29, 8:30 AM, Session H5, Virginia B**

Speakers: Marshall Bautz, John Conklin, Henric Krawczynski, Igor Moskalenko, Ralph Kraft, Mark Bautz, Edward Wollack.

Cosmic Ray Science Interest Group II **Sunday, Jan 29, 1:30 PM Session K4, Room Virginia A**

Speakers: William Vernon Jones, Eun-Suk Seo, Angela Olinto, John Mitchell.

Mini-symposium: Gravitational Waves Science Interest Group **Sunday, Jan 29, 1:30 PM Session K5, Virginia B**

Speakers: John Ziemer, Paul McNamara, Lisa Barsotti, Scott Hughes, Emanuele Berti, Alberto Sesana, Enrico Barausse, Vitor Cardoso, Krzysztof Belczynski, David Shoemaker.

Electromagnetic Follow-up of Gravitational Wave Candidate Events **Sunday, Jan 29, 3:30 PM Session M3, Maryland C**

Speakers: Marcelle Soares-Santos, Judith Racusin, Tyson Littenberg, Steven Liebling, Hsin-Yu Chen, Reed Essick, Salvatore Vitale, Daniel Holz, Erik Katsavounidis, Kendall Ackley, Stephen Eikenberry, Sergey Klimentko, Min-A Cho, Shreya Anand, Leo Singer, Cole Miller.

The Galactic Center Excess **Monday, Jan 30, 10:45 AM Session R5, Room Virginia B**

Speakers: Tim Linden, Anna Kwa, Shunsaku Horiuchi, Manoj Kaplinghat, Andrea Albert, Dmitry Malyshev, Anna Franckowiak, Luigi Tilbaldo, Mattia Di Mauro, Ryan Keeley, Kevork Abazajian, Tansu Daylan, Stephen K. N. Portillo, Douglas P. Finkbeiner, Mattia Di Mauro, Ilias Cholis, Carmelo Evoli, Francesca Calore, Tim Linden, Christoph Weniger, Dan Hooper.

Gravitational Waves and Dark Matter **Monday, Jan 30, 3:30 PM Session U5, Room Virginia B**

Speakers: Ely Kovetz, Simeon Bird, Ilias Cholis, Julian Munoz, Yacine Ali-Haïmoud, Marc Kamionkowski, Ely Kovetz, Alvise Raccanelli, Adam Riess, Timothy Brandt, Massimo Ricotti, Jeremiah Ostriker, Katherine Mack, Katelin Schutz, Masha Baryakhtar, Tanja Rindler-Daller, Bohua Li, Paul Shapiro.

April 2017 (January) Meeting DAP Invited Sessions Highlights

Session E15: Division of Astrophysics Thesis Prize

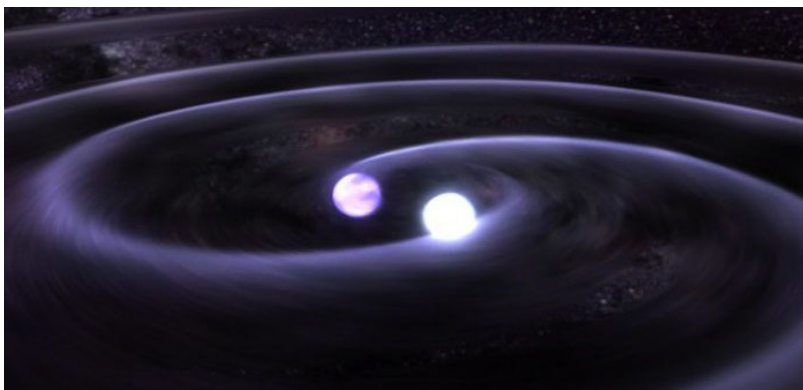
Saturday, January 28, 3:30 PM

Finalists for the DAP Thesis Prize will present the science behind their dissertations. Anna Patej, PhD Harvard University, will discuss her work on the distributions of gas and galaxies on scales from galaxy clusters to larger scales. Garrett Somers, PhD Ohio State University, has developed non-standard models of stellar physics to explain the long-standing mystery of lithium depletion in solar type stars. Morgan MacLeod, PhD UC Santa Cruz, will discuss computational modeling of phases of dramatic interaction that intersperse stellar lifetimes, especially in galactic centers where stars trace dangerously wandering orbits dictated by central, supermassive black holes. Carlos Arguellas, PhD University of Wisconsin–Madison, will present results on the search for sterile neutrinos with the IceCube experiment.

Session B15: Electromagnetic Signatures of Neutron Star Mergers

Saturday, January 28, 10:45 AM

Three invited speakers will report on recent progress in the exciting field of compact object mergers, with a focus on the electromagnetic observables of neutron star mergers. Rebecca Surman will describe how new and anticipated advances in nuclear and neutrino physics are shaping our understanding of nucleosynthesis in the ejecta and disks of double compact systems. Andreas Bauswein will describe the properties of merger transient events within a multi-messenger picture including in particular information that can be revealed from simultaneous gravitational wave detections. Luke Roberts will discuss mergers as likely sites for r-process nucleosynthesis.



Session H15: Cosmology with Ultra Low Mass Fields

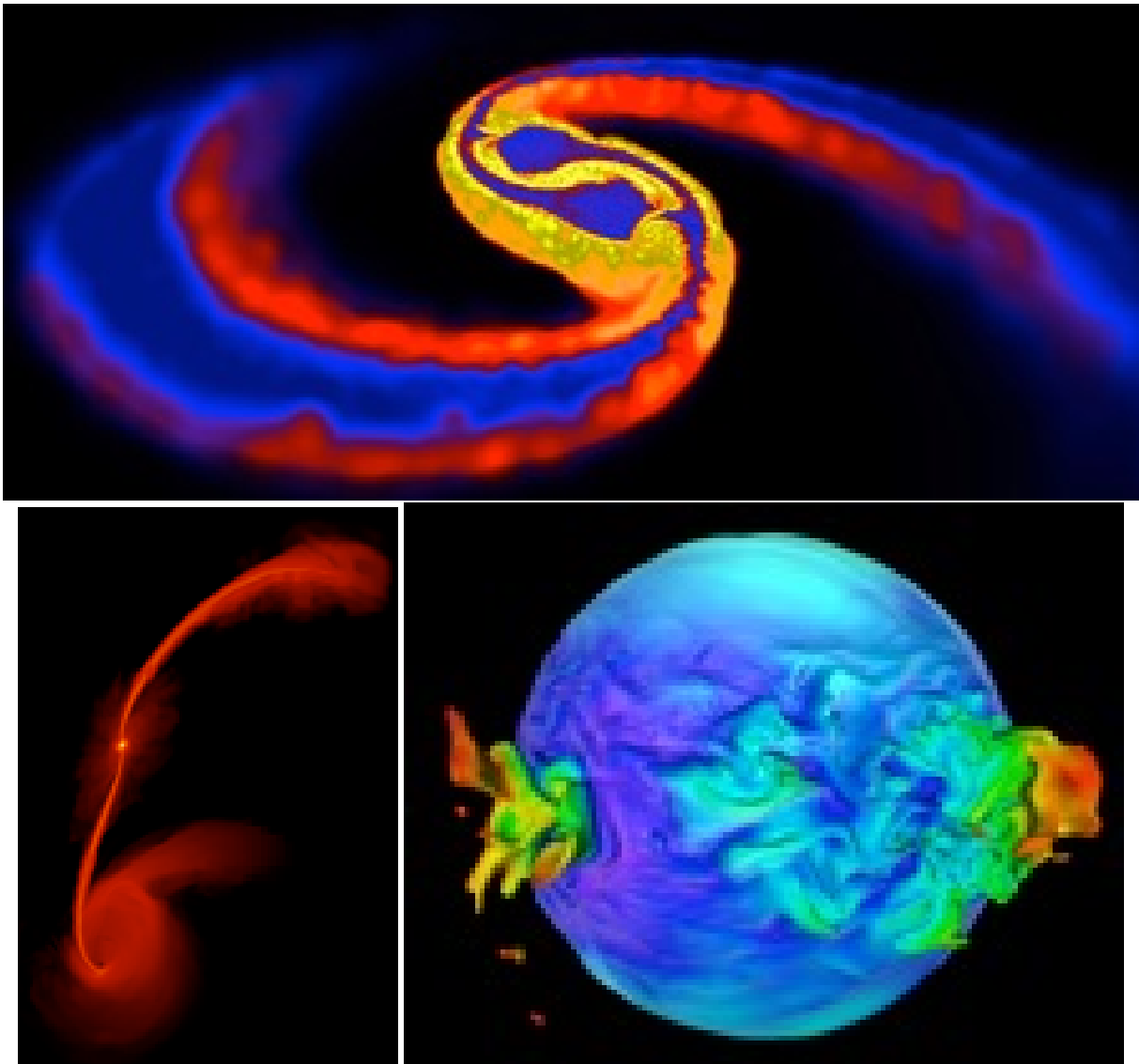
Sunday, January 29, 8:30 AM

Many of the solutions to outstanding problems in modern cosmology posit new, ultra-light fields. Unifying General Relativity and Quantum Mechanics appears to require new ultra-light fields at some level. Such fields are also invoked to drive inflation and dark energy. Ultra-light fields may also make up much or all of the dark matter density of the universe. Peter Graham will discuss precision measurement technologies such as atom interferometry, nuclear magnetic resonance, high precision magnetometry, and torsion balances, which may allow novel, highly sensitive experiments for direct detection of light dark matter and of gravitational waves. Michael Romalis will specifically discuss magnetometer searches for ultra low mass fields, and William Terrano will specifically discuss torsion-balance experiments and ultra-low-mass fields.

Session J15: Prize Talks: Black Holes and Cosmic Explosions

Sunday, January 29, 10:45 AM

The Prize Talks session is always a special event for DAP specifically and for the April Meeting generally. This year we have three exciting prize talks. Martin Rees will present the Lillienfeld Prize Talk, and will review how black holes grow, with particular emphasis on mergers, and on the complex phenomena associated with the tidal capture and disruption of stars. Enrico Ramirez-Ruiz will present the Edward Bouchet Prize Talk, and will describe advances in our understanding of the origin of the heaviest and rarest elements in the Universe. Finally, Stuart Shapiro will give the Hans A. Bethe Prize Talk entitled “Cosmic Collisions Online – Compact Binary Mergers, Gravitational Waves and Gamma-Ray Bursts”. This talk will describe some recent magnetohydrodynamic simulations that show how binary black hole-neutron star and neutron star-neutron star mergers can launch jets, lending support to the idea that such mergers could be the engines that power short gamma-ray bursts, and will also show how the magnetorotational collapse of very massive stars to spinning black holes immersed in magnetized accretion disks can launch jets as well, reinforcing the belief that such “collapsars” are the progenitors of long gamma-ray bursts. We are promised some computer-generated movies highlighting some of these simulations!



Session K15: SN 1987A: 30 Years Later

Sunday, January 29, 1:30 PM

Supernova 1987A has been called the supernova of a lifetime. The brightest supernova since Kepler's in 1604, SN 1987A was detected 30 years ago at a distance of 160,000 light years in the Large Magellanic Cloud, a satellite galaxy of the Milky Way. Visible with the naked eye and detected with the full range of technology constructed since Kepler's time, SN 1987A has continued to be a rich source of empirical information to help understand supernova explosions and their evolution into supernova remnants. While the light output has faded by a factor of 10,000,000 over those 30 years, instrumentation, like the Hubble Space Telescope, the Chandra X-ray Observatory, and the Atacama Large Millimeter Array has continued to improve so that this supernova continues to be visible in X-rays, ultraviolet light, visible light, infrared light and in radio emission. This invited session focuses on the wealth of information that has been gleaned from this rare and rich astrophysical laboratory over the past 30 years. Robert Kirshner will sketch what has been learned from these observations about the pre-supernova star and its final stages of evolution, the explosion physics, the energy sources for emission, and the shock physics as the expanding debris encounters the circumstellar ring that was created about 20,000 years before the explosion. Laura Lopez will review recent advances in the understanding of core-collapse (CC) SNe based on studies of X-ray studies of SNRs. In particular, her talk will focus on SN 1987A and other young CC SNRs, highlighting investigations of their explosion (a)symmetries, heavy metal (like iron and titanium) abundances, progenitors, and particle acceleration. Finally, Sean Couch will present a closing overview on what we have learned about core collapse since SN 1987A.



Session M16: Neutron Skins, Hypernuclei and Neutron Stars

Sunday, January 29, 3:30 PM

Join us for a fascinating session at the interface of nuclear, particle, and astrophysics, using neutron star structure as a unique laboratory. James Lattimer will speak on the nuclear symmetry energy and the mass-radius relation of neutron stars. The implications of recent and forthcoming experiments, such as those pertaining to the neutron skin thickness and astrophysical measurements of various structural properties will be discussed, with an emphasis on pulsar timing, X-ray observations, supernova neutrino detections, and gravitational waves from mergers involving neutron stars. Robert Michaels will describe how the measurement of the parity-violating electron scattering asymmetry from ^{208}Pb has demonstrated a new opportunity at Jefferson Lab to measure the weak charge form factor and hence pin down the neutron radius in nuclei in a relatively clean and model-independent way. This is because the Z boson of the weak interaction couples primarily to neutrons. He will describe the PREX and CREX experiments on ^{208}Pb and ^{48}Ca respectively. Diego Lonardoni will discuss current challenges and future prospects for understanding the possible presence of exotic particles in neutron star interiors.

Session S14: Progenitors of Merging Binary Black Holes

Monday, January 30, 1:30 PM

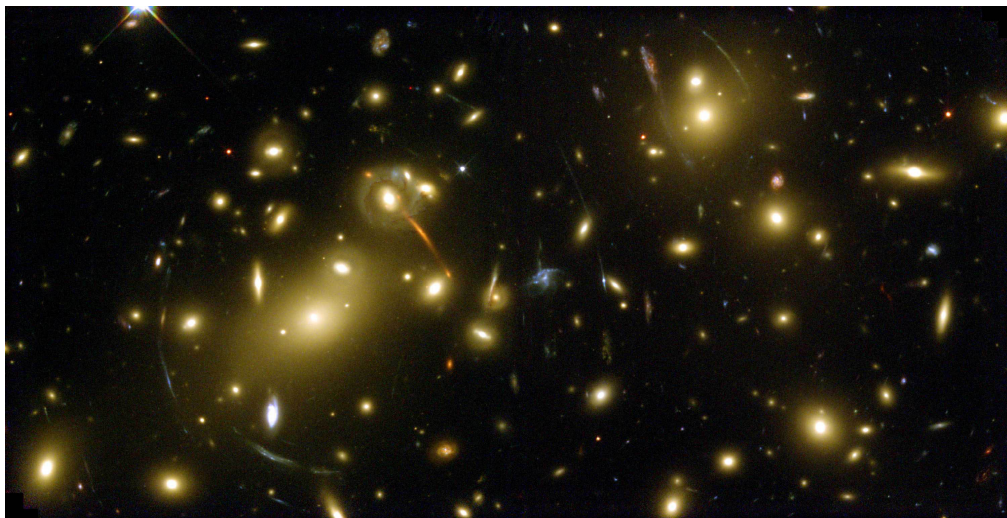
It is now a known fact that merging binary black holes are a reality. This session will explore what is currently known about the progenitors of these systems that will continue to be at the heart of gravitational wave research. Selma de Mink will first discuss classical binary star evolution leading to a binary black hole. Nicholas Stone will overview various dynamical formation scenarios, and summarize the key observational tests that will enable Advanced LIGO or other future detectors to determine what formation pathway creates the majority of binary black holes in the universe. Carl Rodriguez will review our current understanding of star cluster dynamics, describing how binary black holes can be formed through gravitational interactions in dense stellar environments, such as globular clusters and galactic nuclei.



Session U15: New Results from Galaxy Surveys

Monday, January 30, 3:30 PM

Despite tremendous recent progress, gaps remain in our knowledge of our understanding of the Universe. We have not yet pinned down the properties of dark energy, nor have we confirmed Einstein's theory of Gravity at the largest scales. Current and upcoming large sky surveys of Large Scale Structure (LSS) in galaxies, quasars and Lyman-alpha forest present us with the best opportunity to understand properties of the Universe. Shiley Ho will first review recent cosmology results from LSS, concentrating on BOSS and preliminary eBOSS results using Baryon Acoustic Oscillations and Redshift Space Distortions. She will then discuss novel cosmological probes which combine Cosmic Microwave Background with LSS directly, and will put these into the context of upcoming surveys such as Dark Energy Spectroscopic Instrument (DESI), Wide Field Infrared Survey Telescope (WFIRST) and CMB S4. Chris D'Andrea will pick up the theme by discussing new results from SN surveys. Finally, Brian Nord will discuss recent advances in observations and analysis techniques in both weak and strong gravitational lensing, and the burgeoning potential of these techniques to derive important and competitive cosmological constraints from surveys of large-scale structure.



Session X15: Dynamics of Planetary Systems

Tuesday, January 31, 10:45 AM

The rapidly burgeoning field of exoplanet research has opened new opportunities for using astrophysical laboratories for the study of multi-body dynamics. This session will explore some of the fascinating dynamical mechanisms that can help explain the architecture and evolution of planetary systems, including our own solar system. Konstantin Batygin will open the session with a talk in which he argues that the observed clustering of Kuiper belt orbits can be maintained by a distant, eccentric, Neptune-like planet—the so-called Planet Nine—whose orbit lies in approximately the same plane as those of the distant Kuiper belt objects, but is anti-aligned with respect to those of the small bodies. In addition to accounting for the observed grouping of orbits, the existence of such a planet can naturally explain other, seemingly unrelated dynamical features of the solar system. Ruth Murray-Clay will discuss the dynamics of scattering in multi-planet systems, which may explain some of the diversity of planetary system architectures now being observed by missions such as Kepler. Eric Ford will describe the physics of strong interactions in planetary systems, and will focus on the use of transit timing variations (TTVs) as a powerful tool to characterize the masses and orbits of dozens of small planets, including many planets at orbital periods beyond the reach of both current Doppler surveys and photoevaporation-induced atmospheric loss. The talk will describe a few particularly interesting planetary systems and discuss the implications for the formation of planets ranging from gaseous super-Earth-size planets to rocky planets the size of Mars.

