Future Science: The Frontiers of 21st Century Astronomy

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PARTICIPANT BIOGRAPHIES

Rachel Bean is an assistant professor of astronomy at Cornell University working in the field of cosmology--the study of how the universe began and evolved into what we see today. She received her Ph.D. in physics from Imperial College, the University of London. Bean's research focuses on cosmological theories and how astronomers can constrain them using observations such as the cosmic microwave background (radiation emitted at the earliest observable time in the universe's history) and large-scale structure data (galaxies or clusters of galaxies).

At the Cornell Space Science building, Bean builds simulations of how the universe came into being and grew to what we see today, builds statistical models of what may have happened, then calculates how likely it is that the models are correct. Most recently, Bean's research has involved the nature of dark energy, the mysterious quantities responsible for the accelerated expansion of the universe, and dark matter. She is most interested in how to use observations to distinguish between competing theories.

Mark Dickinson is an associate astronomer with the National Optical Astronomy Observatory (NOAO). Dickinson received his Ph.D. in 1994 from the University of California at Berkeley. He then worked at the Space Telescope Science Institute (STScI) and Johns Hopkins University for 10 years as a postdoctoral fellow and then on the STScI science staff, before moving to NOAO in 2004. He has coordinated multiwavelength deep-field surveys using a number of observatories and telescopes including the Hubble, Spitzer, Chandra, and Herschel space observatories, as well as the Keck Observatory, the European Southern Observatory and National Radio Astronomy Observatory's Very Large Array.

Dickinson's research mainly concerns observational studies of galaxy formation and evolution; he observes very distant galaxies in the early universe at many different wavelengths, trying to understand how they formed and evolved. Recently, he has focused his attention on the history of star formation and mass assembly in galaxies, measuring how quickly they formed their stars, and how their total stellar masses grew over time throughout the last 12 billion years or more.

Evalyn Gates is the executive director and chief executive officer of the Cleveland Museum of Natural History. Before beginning this position in May 2010, she was the assistant director of the Kavli Institute for Cosmological Physics at the University of Chicago and a member of the research faculty in the department of astronomy and astrophysics at the University of Chicago, with an active program of research in cosmology and particle astrophysics.

Gates received her Ph.D. in theoretical particle physics from Case Western Reserve University. Her book, titled "Einstein's Telescope: The Hunt for Dark Matter and Dark Energy in the Universe," was published in 2009. The book provides non-scientists with a comprehensive look at developments that have overturned the understanding of the nature of the universe and describes radical new techniques that may bring about the next great scientific revolution.

Lynne Hillenbrand is a professor of astronomy at the California Institute of Technology (Caltech). Previously, she held postdoctoral fellowship positions at Caltech and UC Berkeley and was a graduate student at the University of Massachusetts. Hillenbrand has studied star formation at the extremes—in its earliest stages and at its lowest and highest masses. Her recent research has been directed towards understanding the evolution of circumstellar disks and the process of planet formation in these disks.

Hillenbrand is working on a number of projects involving the young stellar populations within the star-forming regions. Long-standing regions of interest include the Orion Nebula and the North American/Pelican Nebula. She uses observations across the electromagnetic spectrum to understand the properties of the stars—their masses, ages and rotation rates—and the properties of their planet-forming disks.

Patrick McCarthy is an astrophysicist with the Carnegie Observatories at the Carnegie Institution for Science. He received his Ph.D. in astronomy at the University of California, Berkeley. McCarthy uses the facilities at the Las Campanas Observatory to explore the early formation and evolution of galaxies. He focuses on understanding when the first massive, gravitationally bound star systems formed and how diverse properties of galaxies have developed.

Using the IMACS spectrograph on the Baade Telescope, McCarthy explored the connection between environment, mass and star-formation history in distant galaxies. Contrary to the predominant theory, McCarthy and his colleagues have found evidence that the largest and most massive galaxies formed earliest in the universe, while the smaller and dwarf galaxies formed later—with many still forming today.

Miles O'Brien is a broadcast news veteran based in New York City and owns a production company that creates, produces and distributes original content across all media platforms. For nearly 17 years he worked as a correspondent, anchor and producer for CNN based in Atlanta and New York. At various times he was CNN's science, space, aviation, technology and environment correspondent. Since leaving CNN, O'Brien has been involved with Space Flight Now streaming live webcasts of the remaining shuttle launches.

He has completed three documentaries with WNET in New York called "Blue Print America" about improving infrastructure. Currently, he is completing a documentary for PBS Frontline on the crash of Continental #3407 and related aviation safety issues. O'Brien has received numerous prestigious awards over the years for his coverage of space, aviation, science, technology and the environment.

Scott Ransom is an astronomer at the National Radio Astronomy Observatory (NRAO), Charlottesville, Va., and received his Ph.D. in astronomy from Harvard University. Ransom searches for exotic pulsars and times them using their atomic, clock-like, rotational characteristics to probe as much basic physics or astrophysics information as possible.

Ransom works with the Green Bank Ultimate Pulsar Processing Instrument, a tool that is designed to work with the NSF's Robert C. Byrd Green Bank Telescope in West Virginia. With this technology, Ransom and his colleagues at NRAO have discovered the fastest-spinning neutron star, 28,000 light-years from Earth in the Sagittarius constellation. A neutron star is what is left after a massive star explodes at the end of its "normal life."

Edward Seidel is the assistant director for Mathematical and Physical Sciences at the NSF. Seidel has served as Head, Office of Cyberinfrastructure since September 2008. Seidel joined NSF from Louisiana State University (LSU), where he serves as Floating Point Systems Professor in the department of physics and astronomy and computer science, and was also previously founding director of the LSU Center for Computation & Technology. He has also held positions at Max Planck Institute for Gravitational Physics and the National Center for Supercomputing Applications and the University of Illinois, Urbana-Champaign.

Seidel's scientific career has focused on solving Albert Einstein's equations of general relativity, pioneering techniques and algorithms, especially for simulating black hole collisions and gravitational waves on supercomputers. Seidel and collaborators also developed software approaches needed to solve the general relativity equations, which led to development of more general toolkits to attack complex problems from other disciplines using advanced computing environments.

Seth Shostak is a senior astronomer with the Search for Extraterrestrial Intelligence (SETI) Institute and received his Ph.D. in astronomy from the California Institute of Technology. As well as being involved with SETI's research, Shostak is also responsible for many of the institutes outreach activities. He is a science editor for "The Explorer," has published a number of magazine articles and books, and teaches informal education classes on astronomy and other topics in the Bay Area. He also hosts SETI Institute's weekly radio program "Are We Alone?" The show gives callers an opportunity to ask questions of the world's foremost experts in astrobiology and science exploration.

Before his involvement with SETI research, Shostak used radio telescopes in the U.S. and the Netherlands to search for clues to the ultimate fate of the universe by analyzing galaxy motion. As a participant in SETI's observing programs, Shostak is working on the Allen Telescope Array (ATA) project. The ATA is a radio telescope that is under construction in California (the first phase of construction was completed in 2007) that will undertake the most comprehensive and SETI surveys to date.

Jean Turner is a professor of physics and astronomy at the University of California, Los Angeles (UCLA), and received her Ph.D. in astronomy from the University of California, Berkeley. Turner observes infrared and radio emission from

star-forming regions in local galaxies. She is particularly interested in galaxies with extreme star formation, and has been observing the emission from “supernebulae” surrounding young super-star clusters in the process of forming. She also studies the gas clouds in galaxies from which stars form.

With the Keck Telescope, which is jointly operated by the University of California, Caltech, and NASA on Mauna Kea, Hawaii, Turner has observed young super-star clusters in the infrared. Using radio telescopes, such as the NSF's Very Large Array of the National Radio Astronomy Observatory, Turner makes high-resolution images of radio continuum emission from young stars and the gas clouds associated with the stars. Radio and infrared images are often the most reliable way to capture images of young clusters that are deeply embedded in their birth clouds.

Anthony Tyson is a professor of physics at the University of California, Davis. He received his Ph.D. at the University of Wisconsin. His research interests have included cosmology, dark matter, dark energy, observational optical astronomy, experimental gravitational physics and new instrumentation. Specifically, Tyson studies dark matter and dark energy that make up most of the universe. His research aims to reveal the most fundamental mysteries of time, gravity and space.

As a scientist at Bell Labs in the 1980s, Tyson developed a technique to produce images of dark matter, called weak gravitational lensing. Currently, Tyson is the director of the Large Synoptic Survey Telescope (LSST) project and leads a team that will be scanning the night sky every few nights for 10 years once the telescope is complete. Using the LSST, astronomers will be able to map with exquisite precision, how dark matter clumps through space, enabling the ruling out of some dark matter theories.