

The University of California High-Performance AstroComputing Center (UC-HiPACC), based at the University of California, Santa Cruz, was a consortium of nine of the University of California campuses plus three Department of Energy laboratories: Lawrence Berkeley National Laboratory, Lawrence Livermore National Laboratory, and Los Alamos National Laboratory.

UC-HiPACC supported or co-sponsored activities in computational astronomy to further collaborations in fundamental research.

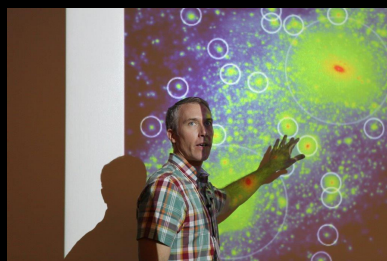
It also raised awareness of computational astronomy—especially the pioneering research throughout the UC system—through education and public outreach.

UC-HiPACC was founded in January 2010 with a five-year grant from the University of California.

This report summarizes the Center's principal programs, activities, and achievements during its five years, January 2010 through December 2014.

Although UC-HiPACC's funding was not renewed, an extension of time for use of unspent funds allows it to continue some activities into 2015, and its website is now being maintained by the University of California Observatories (UCO).

University of California High-Performance AstroComputing Center



Five-Year Report: 2010–2014/5



University of California High-Performance AstroComputing Center



Five-Year Report: 2010–2014/5

Collectively, the faculty and laboratories throughout the University of California system arguably comprise the largest and most powerful computational astrophysics group in the world. The purpose of the University of California High-Performance AstroComputing Center (UC-HiPACC) was to realize the full potential of UC's world-leading computational astrophysics system-wide.



of an obligation to return value to California and to the public: Its outreach activities included developing educational materials made available through websites, planetarium shows, videos, popular magazines, and other media, and distributing visualizations from astrophysical simulations that are both beautiful and educational.

UC-HiPACC accomplished that purpose in four ways. First, it was *multidisciplinary*: it linked theoretical and observational astrophysicists, physicists, earth and planetary scientists, applied mathematicians, and computer scientists across all UC campuses and three DOE national laboratories, to take advantage of California's leadership in computation and related fields. Second, UC-HiPACC was *collaborative*: it fostered researchers' interaction with one another and with rapidly increasing observational data, through mini-grants for travel, support for working groups and meetings, and other mechanisms. Third, UC-HiPACC was *enabling*: it empowered researchers to utilize efficiently new supercomputers with hundreds of thousands of processors—both to understand astrophysical processes through simulation, and to analyze the petabytes (and soon exabytes) of data that will flow from the new telescopes and supercomputers. Finally, as part of a public state institution, UC-HiPACC was *fully aware*

Support for UC-HiPACC, totaling \$350,000 per year for five years, came from the office of the University of California Vice President for Research and Graduate Studies, Steven Beckwith, through the Multicampus Research Programs and Initiatives (MRPI) competition.

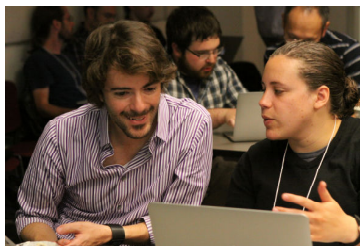
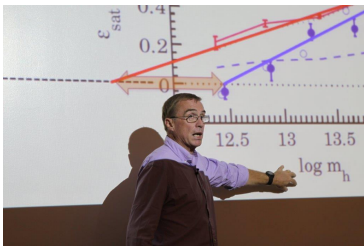
UC-HiPACC's Key Activities

In its five years, UC-HiPACC created and funded two major, important, and original activities.

One, in education, was an annual advanced **International Summer School on AstroComputing (ISSAC)** for graduate students and postdoctoral fellows. Held all five years 2010–2014, each focusing on a special topic in computational astronomy, the schools attracted many of the best young astrophysicists from the UC system, the United States generally, and leading foreign centers.

The other, in research, is the major international **Assembling Galaxies of Resolved Anatomy (AGORA) project** to ensure reproducibility among the leading high-resolution galaxy simulation codes (computer programs), and to help improve the codes so that simulated galaxies look and act increasingly like

All photos in this report are by Tandy E. Bell except as noted



Nick Frey

Sire Grasso

Plenty of time was allotted for formal and informal collaborations at working meetings supported by UC-HiPACC. Lecture, discussion, coffee break images are from 2014 Galaxy, 2013 AGORA, and 2013 Galaxy workshops; group photos are from 2010 Future of AstroComputing and 2012 Galaxy. **ON COVER:** Discussion during 2014 AGORA workshop, group photo from 2011 ISSAC at Lawrence Berkeley Laboratory, UC Irvine astronomer James Bullock speaking at 2014 Galaxy workshop, and 2012 Computational Astronomy Journalism Boot Camp at NASA Ames Hyperwall.

UC-HiPACC Meetings and Schools Held 2010-2014 and One Scheduled for 2015

Dates	Name of Meeting	Meeting Location/s	Total Budget \$K	UC-HiPACC Contribution \$K	Other Sources of Funds	Participants	No. of Faculty	No. of Students
2010								
June 28-30	Enzo User Workshop	UCSD/SDSC	15	5	UCSD, NSF	45		
July 26-August 13	ISSAC 2010: Galaxy Simulations	UCSC	129	84	NSF (\$20K), reg. fees		10	59
August 16-20	Santa Cruz Galaxy Workshop	UCSC	17	6	reg. fees	120		
December 16-17	The Future of AstroComputing	UCSD/SDSC	77	72	UCSD (\$5K)	40		
2011								
July 18-29	ISSAC 2011: Explosive Astrophysics	UCB/LBNL	59	37	DOE (\$15K), reg. fees		14	28
August 8-12	Santa Cruz Galaxy Workshop	UCSC	9	4	reg. fees	86		
2012								
June 14-16	The Baryon Cycle	UCI	20	10	UCI/CGE; reg. fees	130		
June 23-27	Computational Astronomy Journalism Boot Camp	UCSC/NASA/CAS	43	43	none	20	15	
July 9-20	ISSAC 2012: AstroInformatics	UCSD/SDSC	90	70	DOE (\$10K), reg. fees		11	34
August 13-17	Santa Cruz Galaxy Workshop	UCSC	11	5	reg. fees	95		
August 18-20	AGORA kickoff workshop	UCSC	11	11		52		
2013								
July 22-August 9	ISSAC 2013: Star and Planet Formation	UCSC	101	79	reg. fees		16	48
August 12-16	Santa Cruz Galaxy Workshop	UCSC	14	6	reg. fees	95		
August 16-23	AGORA workshop	UCSC	12	12		37		
2014								
February 12-14	The Near-Field Deep-Field Connection	UCI	35	20	UCI/CGE; reg. fees	100		
March 21-22	Computational Astrophysics: Approaching Exascale	UCB/LBNL	8	8		50		
July 21-August 1	ISSAC 2014: Nuclear Astrophysics	UCSD/SDSC	71	51	DOE (\$10K); reg. fees		16	33
August 11-15	Santa Cruz Galaxy Workshop	UCSC	13	6	reg. fees	75		
August 15-18	AGORA workshop	UCSC	15	15		21		
2015 planned								
August 17-21	Santa Cruz Galaxy Workshop	UCSC	12	5	reg. fees			
August 21-23	AGORA workshop	UCSC	20	20				

AGORA = Assembling Galaxies of Resolved Anatomy; CAS = California Academy of Sciences; CGE = Center for Galaxy Evolution; DOE = Department of Energy; ISSAC = International Summer School on AstroComputing; NASA = NASA Ames Research Center; NSF = National Science Foundation; SDSC = San Diego Supercomputer Center. All participants in the journalism boot camp were professional science journalists. Reg. fees = conference registration fees. *Numbers in italics are future estimates.*

real observed galaxies. AGORA collaborators are running high-resolution galaxy simulations with the same astrophysical assumptions in order to compare outputs with one another, with fundamental theory, and with observations. All the outputs are being analyzed in exactly the same way using the *yt* volumetric data analysis and visualization toolkit. UC-HiPACC facilitated those efforts by hosting *yt*-AGORA working meetings and developing software using the latest graphic processing units (GPUs) to allow remote users to interact visually with their supercomputer outputs through their browsers.

In addition, UC-HiPACC sponsored or co-sponsored **working meetings** in northern and southern California that brought together astrophysicists with computer scientists and engineers to extend the state of the art in computation and data analysis (*see table above*). UC-HiPACC also fostered **collaborations across UC campuses and DOE labs** with mini-grants to enable travel and matching funds for computational equipment (*see table on page 5*).

Advancing Education

UC-HiPACC's annual advanced **International Summer School on AstroComputing (ISSAC)** for graduate students and postdoctoral fellows was intended to empower young astronomers with data-intensive methods for comparing massive observational data with massive theoretical outputs. ISSACs also broadened awareness of UC's excellence and leadership in computational astrophysics.

Each year, ISSAC met at a different UC-HiPACC venue and focused on in-depth study of a special topic. Faculty and student lodging, refreshments, some meals, and some travel were supported by UC-HiPACC augmented by registration fees; some years, expenses were defrayed by

a grant from the National Science Foundation or Department of Energy. Relevant computer codes with sample inputs and outputs were made available to all participants on a powerful computer, on which all students had working accounts so they could learn to use the codes hands-on during afternoon workshops. Slides and videos of all ISSAC lectures are posted on the UC-HiPACC website (<http://hipacc.ucsc.edu/>, now maintained by UC Observatories) for scientists and the general public worldwide.

ISSAC 2010 at UC Santa Cruz, directed by Anatoly Klypin (New Mexico State University) and hosted by Joel Primack (UCSC) on **Galaxy Simulations**, featured 10 lecturers and 59 graduate students and postdocs. UC-HiPACC provided supercomputer accounts for students on the Triton system at the San Diego Supercomputer Center (SDSC), plus relevant codes and outputs.

ISSAC 2011 at UC Berkeley and the Lawrence Berkeley National Laboratory, directed by Peter Nugent and Dan Kasen (UC Berkeley and LBNL) on **Computational Explosive Astrophysics**, concentrated on the modeling of core collapse and thermonuclear supernovae, gamma-ray bursts, neutron star mergers, and other energetic transients. The 14 lecturers and 28



Photo by Adler Planetarium

As part of outreach efforts to K-12 students and the general public, UC-HiPACC provided dramatic astrocomputing visualizations to major planetariums, such as the Bolshoi cosmological simulation, shown on the dome of the Grainger Sky Theater of Adler Planetarium in Chicago.



As shown by these images from UC-HiPACC's advanced International Summer School on AstroComputing (ISSAC) from 2012, 2013, and 2014, tours of visualization laboratories, formal presentations, hands-on instruction, informal coaching, stimulating discussions, and relaxation with fellow grad students and postdocs and with faculty were all part of the two- or three-week ISSAC experience.

students were provided with accounts and time on the Hopper supercomputer at LBNL's National Energy Research Scientific Computing (NERSC) Center.

ISSAC 2012 at UC San Diego and the San Diego Supercomputer Center focused on **AstroInformatics**—data mining for computational astronomy, directed by Alex Szalay (Johns Hopkins University) and hosted by Michael Norman (UCSD). The 11 lecturers and 34 students had accounts on SDSC's new Gordon supercomputer.

ISSAC 2013 at UC Santa Cruz and directed by Mark Krumholz (UCSC), focused on the use of large-scale simulations in **Star and Planet Formation**. Accounts on UCSC's new 3,000 core supercomputer Hyades were provided for the 16 lecturers and 48 students, along with all relevant codes plus sample inputs and outputs.

ISSAC 2014 at UC San Diego and the San Diego Supercomputer Center, held July 21–August 1 and directed by George Fuller (UCSD), focused on **Neutrino and Nuclear Astrophysics**. Accounts were provided for the 16 lecturers and 33 students on SDSC's Gordon supercomputer.

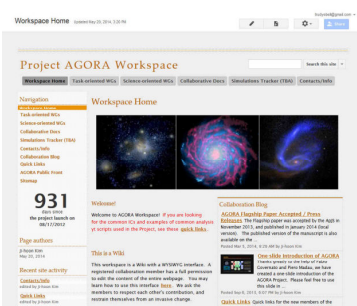
Enabling Research

In 2014, for the third year, UC-HiPACC sponsored the international **Assembling Galaxies of Resolved Anatomy (AGORA <http://www.agorasimulations.org/>)** project. AGORA is a major research initiative now grown to more than 120 astrophysicists from over 50 institutions in eight countries to compare how 10 leading simulation codes model the evolution of galaxies at high resolution, using the same initial conditions, UV background, and gas cooling, and the same analysis code *yt*. During the 2014 AGORA working meeting (August 15–18) at UCSC, 25

leading cosmologists and computational astrophysicists from 13 working groups worked on AGORA's *yt* analysis software and discussed procedures for running, saving, and analyzing galaxy simulations. The analysis focused on comparing both the performance of the codes and the astrophysical results, including comparing the results with astronomical observations. The 2015 AGORA workshop (to be held August 21–23) is expected to finalize several AGORA papers and discuss the cosmological simulation output comparisons.

Many of the working groups are led by postdoctoral astrophysicists or junior faculty members. Between the annual work-

In addition to the annual August (photos from 2014) working meeting for the Assembling Galaxies of Resolved Anatomy (AGORA) research project, the international collaborators communicate through the SeeVogh video conferencing sponsored by HiPACC and through the AGORA website and wiki workspace.



shops, participants work on the project remotely, with web meetings using the SeeVogh web conference platform supported by UC-HiPACC. UC-HiPACC visualization directors Alex Bogert and Miguel Rocha have written code to make high-resolution 2D and stereo images and videos nearly instantaneously from galaxy simulation outputs; this software is now publicly available as part of yt (<http://yt-project.org>).

In January 2014, the 20-page AGORA flagship paper was published in *Astrophysical Journal Supplement*. Several more papers are in preparation. AGORA is also supported by a NERSC Data Pilot Program allocation of substantial computing and storage. In addition, AGORA is supported by the new UCSC Hyades astrophysics computer system, purchased with a NSF MRI grant and including a PetaByte AstroData system donated by Huawei Technologies Co.

Meantime, in all five years (2010–2014), UC-HiPACC co-sponsored the annual **Santa Cruz Galaxy Workshop** at UCSC each August, organized by Primack and Hebrew University Professor of Physics Avishai Dekel. In 2014, the five-day Galaxy Workshop attracted 75 participants from more than 20 institutions worldwide, including from three UC campuses. Slides and videos of all talks are posted on the UC-HiPACC website.

UC-HiPACC also sponsored or co-sponsored special topical conferences. In February 2014, it co-sponsored with the UC Southern California Center for Galaxy Evolution (CGE) a conference at the Beckman Center of the National Academies at UC Irvine, entitled **The Near-Field, Deep-Field Connection**. In March 2014, it co-sponsored with Lawrence Berkeley National Laboratory a conference **Computational Astrophysics 2014–2020: Approaching Exascale**; the twin goals of the

meeting, which attracted 50 participants, were to discuss the future of astrophysics in general and specifically the future of UC-HiPACC.

UC-HiPACC Small Grants Awarded Spring 2010–Fall 2014

Principal Investigator	Type	Amt \$K	UC-HiPACC site(s)	Project
Small Grant Expenditures: Spring/Summer 2010				
Sukanya Chakrabarti	IT	1	UCB, UCI	Dynamical impact of satellites on Milky Way disk
Michele Fumagalli	IT	1	UCSC, UCSD/CASS	Cold gas in high redshift galaxies
Total:		2		
Small Grant Expenditures: Fall 2010/Winter 2011				
David Collins	IT	1	UCSD	Travel to attend Enzo Users Workshop
Donald Korycansky	IT	2	LANL, UCSC	Hazardous asteroids
Michael Kuhlen	IT	2	UCB, UCSD	Travel to attend Enzo Users Workshop
Geoffrey So	IT	2	UCSD	Travel to attend Enzo Users Workshop
Daniel Whalen	IT	1	LANL, UCSD	Work with Enzo on primordial SN remnants
Przemek Wozniak	IT	5	LANL, UCB	Transient classification of petascale sky surveys
Andrea Zonca	IT	1	LBNL, UCSB	Iterative calibration technique for data analysis
Total		14		
Small Grant Expenditures: Spring/Summer 2011				
Michael Boylan-Kolchin	Eq	5	UCI	80-TB data storage for Millenium II-simulation
James Bullock	Eq	10	UCI	Rack server for GreenPlanet Cluster
Asantha Cooray	UR	2	UCI	CMB secondary anisotropies
Jason Dexter	IT	1	UCB, UCSB	Numerical simulations of compact objects
Steve Furlanetto	Eq	7	UCLA	Early universe with a 64-GB workstation
George Fuller	IT	3	LANL, UCSD	Neutrino flavor transformation in stellar collapse
Joel Primack	UR	7	UCSC	Properties of dark matter halos
Andrea Zonca	IT	1	LBNL, UCSB	Bandpass mismatch effect on CMB measurements
Andrea Zonca	IT	1	LBNL, UCSB	Scaling study of CMB mapmaker
Total:		37		
Small Grant Expenditures: Fall 2011/Winter 2012				
Joel Primack	UR	4	UCSC	Semi-analytic models from Bolshoi simulation
Total:		4		
Small Grant Expenditures: Spring/Summer 2012				
Eugene Chiang	UR	5	UCB	Rotation curves of protoplanetary disks
William Dawson	IT	10	UCD, UCI	Merging cluster collaboration
Jose Onorbe	Eq	6	UCI	High RAM/core node
Enrico Ramirez-Ruiz	Eq	4	UCSC	3D Visualization Lab
Andrea Zonca	IT	1	UCD, UCSB	Cosmological parameters estimation with PICO
Total:		26		
Small Grant Expenditures: Fall 2012/Winter 2013				
Charlie Conroy	IT	2	UCSB, UCSC	Stellar evolution and galaxy formation
Dusan Keres	IT	6	UCB, UCSD	Galaxy simulations with realistic feedback
Mark Krumholz	IT	6	UCB, UCSC, LLNL	Conference on yt
Enrico Ramirez-Ruiz	Eq	3	UCSC	Simulation analysis
Total:		17		
Small Grant Expenditures: Spring/Summer 2013				
Jason Dexter	IT	1	UCB, UCSB	radiative transfer calculations compact objects
Total:		1		
Small Grant Expenditures: Fall 2013/Winter 2014				
Matt Turk	IT	5	UCSC	yt workshop for AGORA (March 23-26)
Enrico Ramirez-Ruiz	Eq	4	UCSC	Undergrad lab in computational astrophysics
Charlie Conroy	Eq	10	UCSC	SuperStorage server for 144 TB
Joseph Munoz	IT	1	UCSB/UCLA	collaboration with Frederick Davies
Total		20		
Small Grant Expenditures: Spring/Summer 2014				
Alberto Dominguez	IT	1	UCR	travel to UCSC to work with Fermi, VERITAS groups
Ke-Jung Chen	IT	1	UCSC	visit UCI, UCR, UCD to give seminars and collaborate
Ruobing Dong	IT	1	UCB/LBNL	visit UCSC to work with Shanghai Liu and Doug Lin
Dusan Keres	Eq	4	UCSD	co-fund fast-analysis data storage system at UCSD
Eliot Quataert	UR	4	UCB	non-thermal electrons on resolved images black holes
Enrico Ramirez-Ruiz	UR	3	UCSC	modeling double white dwarf binary star systems
Total		14		
Small Grant Expenditures: Fall 2014/Winter 2015				
Asantha Cooray	Eq	8	UCI	nodes, matching grant
Shawfeng Dong/Ramirez-Rui	Eq	10	UCSC	additional storage for Hyades supercomputer
Smadar Naoz	Eq	10	UCLA	Hoffman2 computing nodes, supporting equipment
Total:		28		
Grand Total 5 years:		\$ 163		

Eq = Equipment matching funds; IT = Intercampus Travel; UR = Undergraduate Research

Previously, in 2013, UC-HiPACC provided staff support for a three-week **Institute for the Philosophy of Cosmology** at UCSC, with funding from a Templeton Foundation grant to Rutgers University. Participants included 28 advanced graduate students and postdocs and 20 lecturers. In 2012, UC-HiPACC co-sponsored the **Baryon Cycle Conference** with the CGE at the Beckman Center at UC Irvine. In the three-day conference, 130 theorists and observers (including ones from seven UC campuses) focused on the cycle of gas through galaxies and the intergalactic medium across cosmic time. In 2010, UC-HiPACC organized a major conference on **The Future of AstroComputing** at UC San Diego and the San Diego Supercomputer Center, for two major purposes: to clarify the big issues for the next five years in astrophysical computation and data, and to bring leaders in the field together to meet with key computational astrophysicists, especially from the UC and other West Coast institutions including Stanford University. Earlier that year, UC-HiPACC co-sponsored an **Enzo User Workshop** at UC San Diego on the cosmology simulation code Enzo.

Attracting \$2M in External Support
 Matching funds that supported UC-HiPACC's five International Summer Schools on AstroComputing (ISAAC) totaled \$25,000 from DoE, \$20,000 from NSF, and \$5,000 from UCSD. Huawei, Inc. gave UCSC a PetaByte AstroComputing storage system worth approximately \$500,000, attached to the UCSC Hyades AstroComputer obtained with a \$910,000 NSF grant. Approximately \$70,000 in UC-HiPACC funds for astrocomputing hardware at UC campuses was matched at least 50-50 by external sources of support. Over 5 million CPU-hours (worth perhaps \$500,000) were allocated by LBNL to support the AGORA project. Nvidia Corp. donated their new Quadro K6000 GPU to UC-HiPACC's 3D VizLab, and zSpace, Inc., donated their new "holographic" 3D visualization product zSpace.

ditions can shape careers: they can learn from other leading faculty members, master skills not taught on their own campuses, line up writers for crucial letters of recommendation, and form other contacts and alliances that can powerfully influence their futures. In 2014, UC-HiPACC funded five **collaborative research efforts** linking six campuses and one DOE lab, **co-funded computational equipment** with matching funds at four campuses, and supported two UC undergraduate research projects. To further aid collaborations, UC-HiPACC supported use of the **SeeVogh** scientific web conference platform.

In all 10 funding cycles from early 2010 through 2014, **42 small grants** totaling about \$163,000 were awarded to researchers at all eight UC campuses with astronomy faculty and all three DOE labs.

Shaping Careers

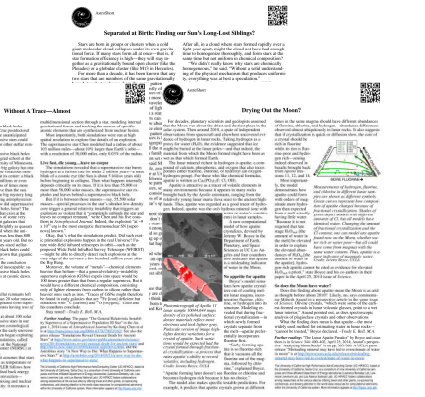
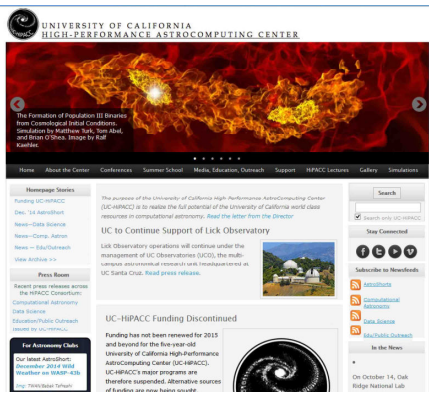
In 2014, for the fifth year, UC-HiPACC sponsored two funding cycles for small grants in support of computational astrophysics research that included collaborations among two or more UC campuses and/or the affiliated DOE labs. For grad students, such travel and collabora-

Outreach

UC-HiPACC provided content from cosmological simulations to several major planetariums. In 2010, it contributed to the show *LIFE: A Cosmic Story* at the Morrison Planetarium of the California Academy of Sciences in San Francisco. In 2011, simulation outputs of black holes and cosmology were prominently featured in *The Searcher*, the inaugural show of the Adler Planetarium's new Grainger Sky Theater. UC-HiPACC worked closely with the scientific staff of both planetariums. In 2013 Primack was an advisor to the American Museum of Natural His-



The 20 journalists accepted to UC-HiPACC's June 2012 boot camp "Computational Astronomy: From Planets to Cosmos" (group photo also shows several of the faculty members) included magazine feature writers, online writers and new media specialists, several public information officers from major universities, an Emmy Award-winning documentary filmmaker, and several international print and broadcast journalists. The boot camp offered two days of intense mini-courses at UC Santa Cruz and an on-campus field trip to the UC Observatories instrument labs; a third day featured field trips to visualization facilities at NASA Ames Research Center and California Academy of Sciences. Shown are seven of the at least 10 resulting online and radio stories and print features in four languages (English, Czech, German, and Spanish), along with a poster (top left) announcing the boot camp.



UC-HiPACC's website home page, now being maintained by the University of California Observatories, was designed to be appealing to students and educators. It archives videos and slides of more than 650 presentations at all of UC-HiPACC's summer schools, conferences, and workshops. Also available are 21 one-page AstroShorts that UC-HiPACC created and published, which describe research in computational astronomy at one of UC-HiPACC's 12 consortium sites, for reprinting in astronomical society newsletters. UC-HiPACC staff published five feature articles in national magazines for the general public (see below); a sixth will be published in Scientific American in June 2015. An external writer published a seventh.

tory on their Hayden Planetarium show *Dark Universe*, which opened in March 2014 in San Francisco at the Morrison Planetarium of the California Academy of Sciences and will be seen at planetariums around the world.

Since joining UC-HiPACC in June 2011, Senior Writer Trudy E. Bell wrote or coauthored with Director Joel Primack and other scientists five feature articles on aspects of computational astronomy for semi-popular magazines (*Sky & Telescope*, *ScienceWriters*, and *The Bent*), most recently a feature on the extragalactic background light, coauthored with Primack and Alberto Dominguez, for *Scientific American* (to be published June 2015). Primack wrote a sixth for *IEEE Spectrum*, and science journalist Brian Hayes wrote a seventh for *American Scientist*. In 2012, Bell inaugurated *AstroShorts*, free approximately monthly one-page features on UC research in computational astronomy designed for reprinting in newsletters of astronomical societies; 21 were published and proved to be very popular. Bell wrote six UC-HiPACC press releases, regularly aggregated news releases about computational astronomy around the UC-HiPACC consortium, and photographed UC-HiPACC events.

Since 2010, UC-HiPACC's site <http://hipacc.ucsc.edu/> posted meeting announcements plus **photographs, videos, and slides from speakers and presenters at UC-HiPACC events**. Significant for both research and outreach, *AstroViz*—the UC-HiPACC Visualization Gallery—debuted on the website in 2012, making astrocomputing simulation images and videos accessible to the scientific community, educators, journalists, and the general public. Also in 2012, Ramirez-Ruiz and Primack created a 3D Astronomical Visualization Laboratory (nicknamed the **3D VizLab**) with partial support from UC-HiPACC. The first 3D VizLab director Nina McCurdy represented UC-HiPACC in the NASA exhibit at Supercomputing 2010, 2011, and 2012, and at the Astro-Viz Workshop in 2011. In 2012, McCurdy presented astro-visualizations at a Goethe Institut art/science symposium in San Francisco. Alex Bogert, who became 3D VizLab director in June 2013, developed a portable visualization software package called pyRGBA, which in-

cludes a hardware volume renderer that can easily be attached to a remote web browser. It generates 2D or 3D simulation output visualization videos in real time on the latest GPUs, including supporting remote streaming, so more people in the scientific community can create visualizations.

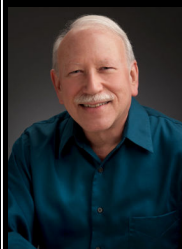
In January 2014, Steve Zaslaw became webmaster to manage the website's archives of lectures, visualizations and reference material, succeeding Eric Maciel. He also increased UC-HiPACC's visibility through social media, and created **two comprehensive Wikipedia articles** on the Bolshoi Cosmological Simulation and on UC-HiPACC.

In June 2012, UC-HiPACC sponsored the first journalism boot camp to be held anywhere on astrocomputing. Called **Computational Astronomy: From Planets to Cosmos**, it consisted of two full days of formal sessions at UC Santa Cruz, in which 15 faculty from six UC campuses and DOE labs presented one-hour mini-courses on key topics in computational astronomy. A third day featured field trips to the Hyperwall of NASA Ames Research Center and the visualization facilities of the California Academy of Sciences in San Francisco. The 20 science and engineering journalists in all media represented publications and other media that collectively reached more than 10 million readers and viewers worldwide. At least 10 features and shows resulting from subjects introduced in the boot camp were published in print or online in 2012 and 2013.





UC-HiPACC Director and Staff 2010–2014/5

**Joel R. Primack, Director**

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Joel R. Primack specializes in the formation and evolution of galaxies and the nature of dark matter, which makes up most of the matter in the universe. He is one of the principal originators and developers of the theory of Cold Dark Matter, the basis for the standard modern picture of structure formation in the universe. With support from the National Science Foundation, NASA, and the Department of Energy, he uses supercomputers to simulate and visualize the evolution of the universe and the formation of galaxies, comparing the predictions of theories to the latest observational data. He is the author, with Nancy E. Abrams, of popular books on modern cosmology: *The View from the Center of the Universe* (2006) and *The New Universe and the Human Future* (2011).

**Trudy E. Bell, M.A., Senior Writer**

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Trudy E. Bell (M.A., history of science/American intellectual history) is a science /technology journalist whose 19 top awards include the David N. Schramm Award of the American Astronomical Society (2006). A former editor for *Scientific American* and *IEEE Spectrum* magazines, she is now a contributing editor for *Sky & Telescope* magazine. She has written or co-authored a dozen books, including a picture history *The Great Dayton Flood of 1913* (2008), the Smithsonian Science 101 volume *Weather* (2007), the Institute of Electrical and Electronics Engineers' millennium book *Engineering Tomorrow* (2000), four books for middle-school ages about the solar system, and five books on bicycling. She has observed five total solar eclipses.

**Sue Grasso, M.A., Administrator**

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Sue Grasso (M.A., education) manages and supervises the operations of UC-HiPACC. She serves as liaison with collaborating institutions, coordinates events, and handles purchases, payments, and travel reimbursements. Her previous experience includes marketing for the University Press at both Yale and UC Berkeley, teaching at the junior high and high school levels, and coordinating GATE (Gifted And Talented Education) and professional development programs for Santa Cruz City Schools.

Past UC-HiPACC Scientific Visualization Coordinators

Left to right:

Miguel Rocha

F. Alex Bogert

Nina McCurdy



Past UC-HiPACC Webmasters and Administrators

Steve Zaslav

Eric Maciel

Carol Connor

Esperanza Zamora



Warm thanks are expressed to the Santa Cruz Institute of Particle Physics (SCIPP) for five years of staff and moral support, especially to Director Steven Ritz and administrators Mykell Discipulo, Georgia Hamel, and Vicki Johnson