

Turning Up the Science When the Weather Gets Cold

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This winter's frigid weather was not enough to dampen the enthusiasm of attendees of the 2014 winter meeting of the American Astronomical Society (AAS), held in National Harbor, Maryland. The meeting offered several opportunities for the community to learn about activities within the *Webb* development project and about the mission's science prospects.

A special session was devoted to the fields of science that will be advanced by *Webb*. Marla Geha (Yale) described how *Webb* will impact studies of galaxy formation by making direct measurements of the stellar initial mass function in galaxies different from the Milky Way. Matthew Tiscareno (Cornell) reported

on the wealth of solar-system science to be done with *Webb*, commenting that *Webb* may be able to witness the birth of new moons in the solar system. He described solar-system science as the "ground truth" for studies of exoplanetary systems. Alicia Soderberg (Harvard) discussed supernova studies with *Webb* and the importance of multi-wavelength observations in interpreting and understanding the explosions. She introduced a "sonification" technique to study the intricacies of each stellar explosion. Mark Wyatt (Cambridge) described how debris disks give insight into the architecture of planetary systems, and how *Webb* results will constrain models of planet formation and evolution. John Johnson (Harvard) discussed exoplanet characterization using *Webb*—measurements of planet radii and spectroscopy of the atmospheres of Earth-like planets—which will complement *Kepler* results and research by other new missions and ground-based surveys (Figure 1). The presentation slides at the *Webb* special session are available at <http://www.stsci.edu/jwst/doc-archive/presentations>.

For the first time, the *Hubble* and *Webb* missions held a joint town hall meeting at the AAS, to apprise the community on the performance of *Hubble* and the progress on *Webb*. The Institute's Ken Sembach updated the audience on the health of *Hubble*, and noted that an overlap of one or more years of operations appears feasible. Eric Smith from NASA Headquarters described the achievements of the *Webb* project during 2013, including completion and delivery of numerous components of the observatory (see Figure 2). The accompanying article by Scott Friedman and Randy Kimble discusses the first cryogenic tests of the integrated science instrument module. Adam Riess, of the Johns Hopkins University and the Institute, gave a science talk on narrow-field, precision cosmology with *Hubble* and *Webb*, describing how *Webb* can realize a one percent error on the Hubble Constant. (The town-hall presentations are also at the above web link.)

Webb was featured in talks at an exhibit about future missions organized by NASA Headquarters. The *Webb* team also arranged several field trips, on the last day of the meeting, for attendees to visit NASA's Goddard Space Flight Center, where several components of *Webb* (e.g., mirrors and instruments)

are undergoing tests. The Institute also led several activities involving social media and public outreach related to *Webb*. Employing Twitter to communicate with the public, we promoted *Webb* opportunities, broadcast news items, and highlighted synergies with science presented at the meeting. We counted ~20,000 tweets during the AAS meeting, and "#JWST" was one of the most widely used hashtags.

The Institute also organized numerous Google hangouts, live from the AAS, which included interviews with NASA and community program scientists, students and postdocs, and even high school students who presented research at the meeting.

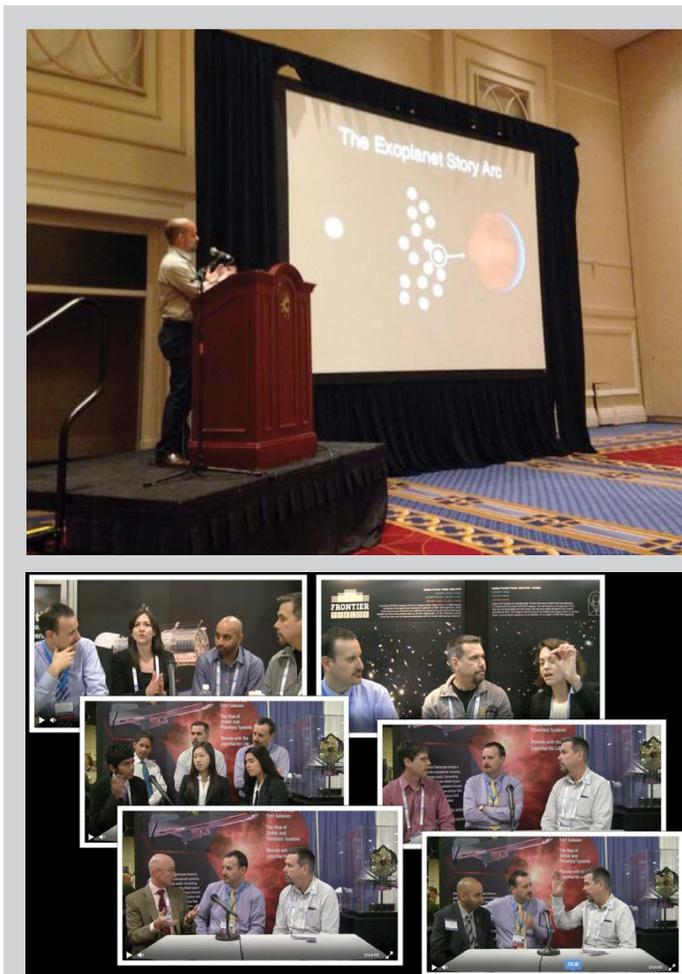


Figure 1: (top) John Johnson giving one of the talks in the *Webb* science session at the AAS meeting. (Photo courtesy of Jason Kalirai). (bottom) Photo montage of Google hangouts at the Institute booth. (Photos courtesy of Tony Darnell.)

Scientists from the Institute interacted with other astronomers at the AAS about new developments in the *Webb* proposal-planning process. They gave demonstrations of the new planning tool for NIRSpec's multi-object spectroscopy (see article by Diane Karakla in this edition of the *Newsletter*). Institute scientists also sought community feedback in the form of user surveys, for example, about the vision for the *Webb* exposure time calculator, and about formats for disseminated documents and other information.

Engaging the Science Community: the *Webb* Science Corner

Even though the launch of the *Webb* mission is still four years away, momentum is building in the astronomical community, anticipating the types of scientific advances *Webb* will make possible. Since the re-planning of the mission in 2011, an average of about 15 papers per month have appeared in the refereed scientific literature with a mention of how *Webb* will address the questions pertaining to a particular science topic. The Institute is harnessing this enthusiasm by organizing a "*Webb* Science Corner" (<http://www.stsci.edu/jwst/jwst-science-corner/>). To build the material available at this site, we canvass the current literature and invite authors to provide a short description of how *Webb* will advance their science. The response has been overwhelmingly positive, and to date, more than three-quarters of those approached have agreed. The science topics are diverse, covering the whole gamut from star formation to exoplanet science, to topics in the high-redshift universe.

As an example, Fabio Pacucci of Scuola Normale Superiore in Pisa, Italy, published a paper describing the detectability of free-floating planets in open clusters with *Webb* (2013 ApJ, 778, L42). The paper predicts that a large population of these exotic objects could be detected with near-infrared imaging with *Webb*—possibly planets as cold as 300 K, and certainly any planet as warm as 500 K. This research would explore diverse modes of planet formation and offer a unique insight into the dynamics of dense stellar systems.

Rafael de Souza of the Korean Astronomy and Space Science Institute recently wrote a paper discussing the detectability of the first cosmic explosions in the universe (2013 MNRAS, 436, 1555). The stars producing the first supernovae explosions signal the end of the cosmic dark ages and the beginning of heavy-element production. While these population III stars have eluded detection thus far, simulations of the death of massive, first-generation stars—coupled with a realistic observing strategy using *Webb*—have found that the brightnesses and detection rates are feasible. Locating the birthplaces of these first stars is important for understanding cosmic evolution.

If you have a paper that discusses the utility of *Webb* observations to tackle one of the broader current science questions, please consider contributing to the *Webb* Science Corner at <http://www.stsci.edu/jwst/jwst-science-corner/submit-information-jwst-corner>.

South by Southwest, Take Two

The Institute partnered with NASA Goddard, NASA Ames, Northrop Grumman and University of Texas (UT), Austin to bring *Webb* and *Hubble* back to the South by Southwest (SXSW) Festival in Austin, TX, from March 7–9, 2014. The team reached thousands in the general public with messages about *Webb*, *Hubble*, and *Kepler* in events ranging from public talks at UT Austin to the official SXSW interactive panel, "First Signs: Finding Life on other Planets." Social media reached millions more. During the festival, *Webb* and *Kepler* scientists also participated in a highly successful "Tweet Chat," where the general public asked science-related questions via Twitter; this interaction resulted in 9.8



Figure 2: Photo montage of progress in 2013 on different aspects of the *Webb* mission. Photo courtesy of Eric Smith (NASA Headquarters).

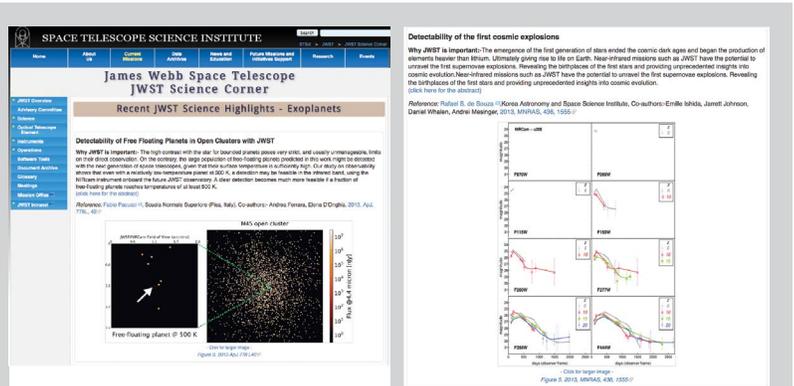


Figure 3: The *Webb* Science Corner features recent results from refereed science papers that discuss how *Webb* will advance the science in their field. These papers discuss, respectively, the detectability of free-floating planets in open clusters (left side of the figure) and the detectability of the first cosmic explosions with *Webb* (right side of the figure).



Figure 4: The Institute's Frank Summers discussing the *Webb* mission to attendees at the SXSW festival in Austin. The *Webb* 13-foot mirror display is visible to the left, and the interactive Microsoft screen is on the right. Image credit: Mike McClare.

million impressions. The booth featured the Institute's 13-foot mirror display and interactive Microsoft screens that allowed astronomers to engage the crowd through incredible, high-quality *Hubble* and *Kepler* imagery (see Figure 4).

SXSW brings together leaders in innovation from around the world, and the *Webb* and *Hubble* display fit right in among the festival highlights. One participant walked away from the booth telling his friend, "That was the best conversation I've ever had in my life!" Visitors at the exhibit spanned all ages, from children to adults—many remembering the *Webb* full-scale model display from the year before—and all sharing their enthusiasm to unlock the great mysteries of the universe when *Webb* launches in 2018.

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