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Over the past year, in addition to continued, highly successful operations and science, *Chandra* has been involved in a number of unusual, unexpected, and/or exciting activities. It has been a year in which the extended team has again, frequently and reliably, demonstrated the talent and dedication which make *Chandra* such an interesting, exciting and amazing mission with which to be involved.

The month of August was the most memorable. As we geared up for the Solar Eclipse on 21st August, for which many of us were traveling to the HEAD meeting (strategically placed and timed well in advance) in Sun Valley Idaho, LIGO reported its first trigger on a NS-NS merger, GW170817, quickly followed by a Fermi gamma-ray detection of a faint, short GRB. The LIGO-linked astronomical community went wild, scrambling to observe the source in as many wavebands and with as many facilities as possible in order to detect, track and characterize the first GW-source electromagnetic (EM) counterpart. *Chandra* was no exception. Three teams triggered pre-approved ToO observations, eventually resulting in three observations, the first two days after the LIGO trigger, and two more observations over the next two weeks. In order to be certain a strong detection was made before the source went behind the sun, we also approved a DDT observation, providing proprietary access to all three teams. Still embargoed (by the LIGO collaboration) ATELs abounded, papers were prepared, rumors flew, journalists became adept at pouring through mission observation logs and contacting astronomers in an attempt to learn what was going on. The "best known secret" in astronomy came to a head on 16th October at a dual press conference reporting all aspects of the discovery to date. The initial non-detection and subsequent detections in the X-rays were pivotal in confirming the source to be an off-axis short GRB (*http://chandra.harvard.edu/press/18_releases/press_011818.html*, and Project Scientist's report on page 11).

Chandra observations of GW170817 continued, using DDT time with publicly distributed data. Observations in early December, as the source transitioned from sunblock, showed that it had brightened in concert with the radio flux, confirming synchrotron as the emission mechanism in both wavebands. Possible explanations for the source of the emission include: a cocoon of gaseous debris heated by a failed off-axis jet; a structured relativistic jet in which our line-of-sight passes through wider, less-relativistic wings on the outer edge; or a quasi-spherical, mildly-relativistic outflow of debris (Mooley et al. 2018, Ruan et al. 2018, Margutti et al. 2017). The January *Chandra* observations are now complete and may help to constrain these various possibilities. This first EM detection of a LIGO GW source heralds a new era in astrophysics, deemed "multi-messenger", in which GW detectors will work in concert with multi-wavelength (radio-gamma-ray) EM astronomy to observe and study the densest objects in the Universe.

"What about the Solar Eclipse?", you may ask. Well…I witnessed it happen, exactly as and when predicted, on Aug 21st 2017, along with a large fraction of the citizens and residents of our nation, and people from around the world. It was my first time, and an unexpectedly profound and moving experience astronomically, personally and socially, bringing tears to my eyes and a shiver down my spine. So many people worldwide united to watch the amazing and once-scary phenomenon of the sun disappearing, for all too short a time, in the middle of a cloudless, (for me) warm day in the hills of Idaho. I am hooked and already looking for the next one!

Our summer workshop: "From *Chandra* to *Lynx*: Taking the Sharpest X-ray Vision Fainter and Farther", brought together >100 scientists to leverage *Chandra*'s legacy and maximize its impact on the development of the *Lynx* mission concept. *Lynx* promises to be a true *Chandra* Successor, aiming to continue *Chandra's* unique, high-resolution quest, and to look much deeper into the otherwise invisible X-ray Universe. The workshop was a great success (see article on page 29 for a review). One major result of these discussions was the release of a Special Call for *Chandra* proposals for pathfinder science to demonstrate the feasibility of a *Chandra* Successor Mission (CSM) and for which up to 1 Ms of DDT time are being made available. The initial call for White Papers, to assess the level of interest and feasibility, resulted in 29 responses—more than expected—and a review panel of external and internal scientists recommended that the Special Call go forward. Twenty-seven CSM proposals were received by the 24 Jan deadline. A review panel was convened on 14 Feb and recommended that 3 proposals be approved. The results were announced on 23 Feb and can be found at: *http://cxc.harvard.edu/target_lists/cycle19/csm_cyc19.html*. Approved observations will be scheduled as early as is possible given the combination of observational and feasibility constraints. The aim is to allow the results to be included in the case for a *Chandra* Successor Mission being submitted to the 2020 Decadal Survey.

The Cycle 19 proposal call included a number of updates which were the result of various community discussions including: the 2016 summer workshop (*http://cxc.harvard.edu/cdo/cxo2lynx2017/*), the *Chandra* Users' Committee, direction from NASA in 2016 to ensure that we maximize the science of NASA's missions, and attendance by various *CXC* staff at several multi-wavelength transient

science meetings over the past 2–3 years. First, we once again included Very Large Projects (>1 Ms of time), which resulted in the approval of 2 VLPs including ~2.6 Ms of observing time. Second, we negotiated an increased amount of joint observing time to be made available for *HST*, *XMM-Newton*, and *NuStar* joint programs, reserving these new allocations for LP and VLP *Chandra* proposals. Third we were able to increase by 50% the amount of funding allocated to archival programs in Cycle 19, which resulted in the approval of a record number of 24 archive proposals. In addition, following discussion at the Jan 2017 meeting of NASA mission leaders convened at NASA's request by *CXC* (Wilkes) and *HST* (Wiseman) at the AAS, we have continued to consult with other observatories, in particular *NuStar*, to plan a one-stop website which will provide easy access to the planned and as-run observing schedules of as many observatories as possible. This will not only increase communication on observation planning, particularly important for the transient science community, but will also facilitate maximization of science by coordinating multi-facility observations when possible, even when this is not part of an approved joint program.

Over the past year, *Chandra* has continued its excellent performance, observing at high efficiency despite the continued challenge of maintaining the thermal balance of the various subsystems as the thermal insulation degrades. In Cycle 20 there continues to be only one limitation on proposal submission as a result of the operational complexities: a maximum of 2 Msec of observing time will be allocated within 60 degs of the ecliptic poles to Large and Very Large programs (Sect 4.2 of the *CfP*). With the release of the Cycle 20 Call for Proposals, we also released an update of our science website (*http://cxc.harvard.edu/*), and seek your comments on this redesign. Science highlights for the year, in addition to the GW170817 observations, included observations of Jupiter in concert with the Juno satellite which detected X-ray aurorae at both north and south poles (*http://chandra.harvard.edu/photo/2017/jupiter/*, also see the HRC article on page 15), observations of Sgr A* and M87 coordinated with the first major EHT observing run in April (results still TBD), and the multi-wavelength (X-ray, radio, optical) picture of merging cluster Abell 3411-3412 on the cover of the first issue of Nature Astronomy (*http://chandra.harvard.edu/press/17_releases/press_010517.html*).

Another major activity for 2017 was the submission of a proposal to extend the *CXC* contract to continue *Chandra* operations from 2018–2027, including a three-year close-out period to 2030. This is aimed at replacing the current *CXC* contract between NASA and SAO to operate Chandra through Sept 2018 followed by a one year close-out. A new, major, unexpected activity, which will take around two years to complete, is the move of the Operations Control Center from its current location in Kendall Square, Cambridge to a location in Burlington, off Rt 128. This necessity is due to our present landlord being unable to extend our lease past Sept 2019. Planning for the move is already well along, thanks to the huge efforts of many *CXC*, NASA and Smithsonian staff, under the leadership of *CXC* Manager, Roger Brissenden (see the Program Manager's Report on page 12 for more details). NASA has transitioned its Senior Review of operating missions to a three-year cycle, so the next will take place in early 2019 rather than this coming year, a welcome relief given the activities described above. On a somber note, we suddenly and tragically lost our long-time, charismatic, Lead Mission Planning Engineer, Brent Williams, in early November (see article on page 24). The incredible turnout (>1000 people) at his funeral events was a visual and humbling testament to the number of lives he touched, well beyond those at the *CXC* who miss him every day.

The Einstein Fellows Program, formerly managed by the *CXC*, has completed its transition, along with *Hubble* and Sagan Fellows, to a merged NASA *Hubble* Fellowship Program (*https://nhfp.stsci.edu/*). This merged program is being hosted by STScI and administered jointly by the three leads from CXC, NeXSci and HST. Applications were submitted via a single portal and were assessed by joint review panels who met in Washington DC in late January (see article on page 35).

Figure 1: Dr. Zurbuchen holding a supernova remnant in his hand at the *Chandra* booth at the AAS meeting

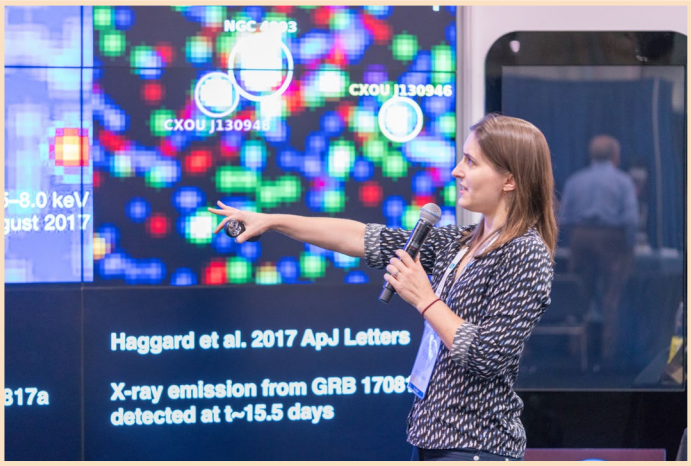

Figure 2: NASA hyperwall presentation on GW170817 by Dr. Melanie Nynka, McGill University.

The 2018 AAS in Washington, DC brought with it another opportunity to meet Dr. Thomas Zurbuchen, the NASA Associate Administrator for the Science Mission Directorate. Dr. Zurbuchen once again toured all the NASA mission exhibits, including the *Chandra* booth (Figure 1), spending significant time meeting and talking with staff. Once again several *Chandra*-related presentations were given at the NASA hyperwall, which provides a wonderful display to highlight the spectacular *Chandra* and multi-wavelength data (Figure 2). *Chandra* exhibit activities included: information and demonstrations of the *Chandra* Source Catalog V2.0, expected to be completed in early spring (see article on page 27); two VR activities: a 3D tour of the supernova remnant Cas A, and a simulated, dynamic, 4π view from Sgr A* of the surrounding stars, hot gas, and outbursting sources (the subject of a press release: *http://chandra.harvard.edu/photo/2018/gcenter360/*); communication products developed as part of the Universe of Learning NASA-CAN project, of which the *CXC* is a member; and a new educational activity. The booth was uniformly busy and great fun!

Finally, we are turning our eyes to the 20th anniversary, in 2019, of *Chandra*'s launch on the shuttle Columbia on 23rd July 1999. This is an amazing feat for a free-flying mission, and we have convened teams and committees to design, prepare, and produce products and events throughout 2019 in recognition and celebration. While planning is in the early stages, we expect to include a major science symposium, a reception in the Boston area, publication of an e-book on 20 years of *Chandra* science, and the release of anniversary products, articles, and presentations distributed throughout the year. Please stay tuned! ■

References

Margutti et al. 2017, ApJL, 848, L20
Mooley et al. 2018, Nature, 554, 207
Ruan et al. 2018, ApJL, 853, L4