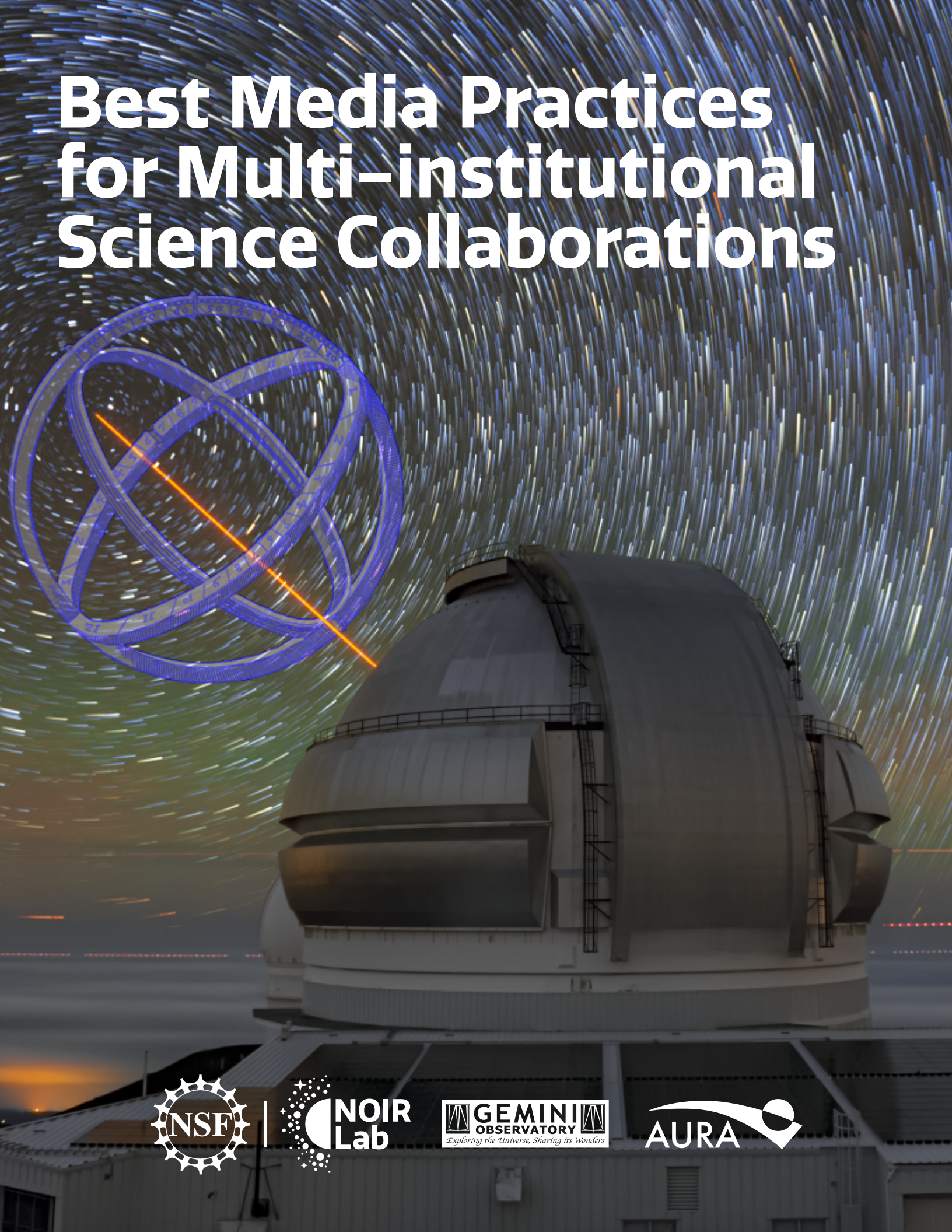
Best Media Practices for Multi-institutional Science Collaborations



NSF | NOIR Lab

GEMINI OBSERVATORY
Exploring the Universe, Sharing its Wonders

AURA

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Fig. 1: Participants in the Multi-Messenger/Time-Domain Astronomy Summit. Credit: NOIRLab/NSF/AURA

Preface

In November 2019, 32 news media professionals and representatives from the National Science Foundation (NSF) and the Association of Universities for Research in Astronomy (AURA) gathered in Baltimore for the Multi-Messenger/Time-Domain Astronomy Summit, funded by the National Science Foundation as part of the Broader Impacts component of the Gemini in the Era of Multi-Messenger Astronomy (GEMMA) grant.

The Summit included prominent public information officers (PIOs), journalists, scientists, and other experts in astronomy communications. Participating PIOs included staff from NSF, the National Aeronautics and Space Administration (NASA), European observatories, several facilities from what is now NSF's NOIRLab, National Radio Astronomy Observatory (NRAO), American Astronomical Society (AAS), Caltech, and other universities. The participants shared their experiences of global media campaigns, including some of the biggest astronomy announcements of the decade: LIGO's two major news announcements — in 2016, the first direct detection of gravitational waves and, in 2017, the first detection of an astronomical event in both gravitational waves and optical/infrared light — and, in 2019, the Event Horizon Telescope's unprecedented international announcement of the first image of a black hole involving six simultaneous news conferences around the globe led by NSF in Washington, D.C. and ESO in Brussels, Belgium (Christensen et al., 2019).

From one of the Summit's core discussions, participants developed an outline of best practices for large astronomy media campaigns. With today's astronomy collaborations growing larger and more complex than ever before, this document provides a framework for helping organizations coordinate their news announcements and press events, and more effectively and collaboratively share astronomy's awe-inspiring discoveries with audiences around the world.

The Summit was facilitated by Janesse Brewer of *23.4 Degrees* and held at the Space Telescope Science Institute in Baltimore. While this document is largely focused on preparations for large media events such as these, many of the principles can be applied to smaller results as well.

Fig. 2: Press conference at an AAS meeting. Credit: AAS.

Fig 3: Images from the Gemini Observatory showing visible light from the gravitational wave event GW170817 in the galaxy NGC 4993. This was the first time gravitational waves and electromagnetic waves were connected to the same event — a multi-messenger event. Credit: International Gemini Observatory/NOIRLab/NSF/AURA.

Introduction

Until the mid-20th century, our view of the Universe was limited almost entirely to the narrow band of the electromagnetic spectrum that could penetrate the Earth's atmosphere and was visible either to our eyes or to sensitive photographic plates loaded at the focus of increasingly large telescopes. The first major expansion of our view came with the development of radio astronomy, leading to the realization that the Universe could look very different when seen through different "eyes" tuned to a different type of radiation. Since then, astronomers have studied the Universe at all wavelengths, and this more complete — multiwavelength — view has produced a wondrous and often breathtakingly beautiful picture of a Universe whose richness could not have been imagined.

However, over the past decade or so, discoveries have been made with "messengers" from space that go beyond photons, the messenger of light: particles from distant galaxies, neutrinos from the Sun and supernovae, and most recently ripples in the fabric of spacetime itself, known as gravitational waves. *Multi-Messenger Astronomy* is now the term we use when astronomers detect the same object or event with either light and particles, light and gravitational waves, particles and gravitational waves, or all three together (which has yet to occur). As the science in each of these three areas advances, these multi-messenger events will reveal an even more complete picture of the Universe and we will learn more about our cosmic history than any one of these individual types of signal, or messengers, can provide in isolation.

At the same time, a growing realization of the Universe's dynamic nature has crept into astronomy. Things that "go bump in the night" are not new: comets, shooting stars and planets

have been observed and discussed for millennia. However, by and large, our Universe has on larger scales seemed static and only evolving over cosmological timescales. Over the past few decades, it has turned out that there is a lot more action than we thought, and sometimes on short timescales like days, hours, seconds or even less. Supernovae explode, stars change in brightness, novae flare, and outbursts occur in regions around black holes.

Astronomy is a discipline that has, throughout history, relied on the collaborative efforts of teams of scientists and engineers. One of the best-known astronomers of all time, Edwin Hubble discovered, in the 1920s and 1930s, that our Milky Way is just one of many galaxies in an expanding Universe — but even his achievements depended on other people. Not only did Hubble collaborate with other scientists, but his research relied on the efforts of a large and diverse team that helped build and run the Mount Wilson Observatory, where Hubble made his historical observations.

Today, as observatories on the ground and in space become larger and more complex, so too do the collaborations of scientists and engineers who build and use the facilities to carry out their research. The Laser Interferometry Gravitational-Wave Observatory (LIGO) is a prime example, involving thousands of team members distributed across the globe. Teams work at NSF's twin LIGO detectors, located in Washington state and Louisiana, and the LIGO Scientific Collaboration (LSC) is the body of nearly 1,300 international scientists who carry out LIGO research, and who hail from more than 100 institutions. This is in addition to the hundreds of team members at LIGO's partner observatory in Europe, the Virgo gravitational-wave observatory. What is more, LIGO has now partnered with the Kamioka Gravitational Wave Detector (KAGRA) in Japan and is in the process of building another observatory in India. LIGO India is expected to join the network of observatories in 2025, marking the beginning of a truly global effort to catch ripples in the fabric of space and time. There are several funding agencies supporting LIGO and its partners, and while the largest and most sustained investment has come from the National Science Foundation (NSF), all partners contribute support to the overall scientific achievements, and each has its own stories to tell and experts to highlight. Additional examples of global astronomy collaborations include the Event Horizon Telescope (EHT), with thirteen stakeholder

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”

institutes, more than 50 affiliated organizations and 11 telescope sites on 4 continents, working together to capture the first-ever images of black holes and probe their environments. In October of 2022, Vera C. Rubin Observatory, funded mainly by NSF and DOE, will begin a ten-year mission to produce a deep, wide, multi-band photometric map of approximately half of the sky. The survey is expected to yield 10 million transient “alerts” for such changing phenomena each clear night, ushering in a golden age for Time-Domain Astronomy.

The traditional way of doing astronomy — where individual astronomers travel to a telescope, take a spectrum of a galaxy and then go home and analyze it — will remain an option, but chances are that the big discoveries will be made by big-science infrastructures in big multi-institutional collaborations, and possibly increasingly in new areas like Multi-Messenger and Time-Domain Astronomy. As ordinary matter accounts for only around 5% of the Universe, the remaining 95% is largely undiscovered. Who knows what kind of new physics will come out of these two up-and-coming areas of astronomy, and this involves tremendous opportunities, but also challenges, for science communicators. At the same time, it is also clear that the communication needs of our society and its citizens have changed.

With so many astronomy partners stretched around the globe, and so many varying levels of involvement and investment, the challenge of coordinated media campaigns, especially for big discoveries, is formidable. In this document, we present recommendations for best practices in respect of how to organize and prepare for large media campaigns so that all parties have an opportunity to share their stories across an international audience, core messages emerge while multiple perspectives are maintained, and collaborative outreach reinforces global impact instead of infighting diminishing it.

Organizing the Players

Developing a media campaign for a large international astronomy collaboration requires a clear organizational hierarchy with an agreed communications plan and well-defined roles and responsibilities. Ideally, the astronomy collaboration presenting the results will have a full-time communications specialist, or Public Information Officer (PIO), who leads the press efforts in coordination with the many PIOs from the collaboration's various institutions and stakeholders, as well as key scientists on the project who can speak with clarity and authority to both the public and fellow scientists in the collaboration.

A PIO representing the collaboration serves as a primary point of contact for communication issues, and greatly helps in establishing a chain of command.

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Big science collaborations may involve dozens or even 100+ organizations so the media coordination work should not be underestimated. A designated project PIO is beneficial because he or she will not hold a bias toward any one organization and will represent the collaboration as a whole.

When a multi-institutional collaboration does not have its own PIO, the other PIOs from relevant institutions will need to work together to organize the press event. This was the case for LIGO's big news announcements, where PIOs from Caltech, Massachusetts Institute of Technology (MIT), and NSF worked together with many press representatives and scientists from Virgo and dozens of other partner institutions around the world. This was not ideal because it was not always clear who was in charge. Additionally, none of the institutional PIOs truly represented the organization as a whole. For this reason, we recommend that, if a full-time project PIO does not exist, a participating PIO or another expert in media communications be assigned to lead the press efforts and help establish who has the decision-making authority and process. Another important step is to set up a secure and globally accessible, common collaborative platform. A common tool facilitates the flow and exchange of information and gives real-time access to important texts, files and materials for all of the PIOs wherever they operate from.

The organization of the press players should be done in close connection with the science teams. Roles and responsibilities for PIOs and the scientists should be defined, and a regular meeting schedule should be set that accommodates different time zones, along with a communications plan that outlines all the activities and products to be developed. It is also important to establish that the media professionals are in charge of the overall media campaign, since they are the experts in communication. Equally, if not even more, important is to make sure that all collaborators are aware that the communicators *do not own the scientific message*, but manage issues of communication style, infrastructure, distribution, timing etc.

By way of an example, for the EHT's current activities, communications leadership falls to three collaborating scientists who are available at all times and who initiate regular meetings, in which they invite input from the many engaged PIOs. The scientists provide the overall structure and liaise with the broader research collaboration, while the PIOs provide communications expertise for the content produced in a collaborative manner.

Timing

Coordinating a "big science" campaign can take months, and for larger international announcements, more than a year. Planning for LIGO's first big press conference (held in 2016 at the National Press Club in Washington DC) began nearly six months before the event. Planning for EHT's announcement began more than two years prior to the announcement. It is crucial to start planning as soon as possible — to organize the players, identify what plans need to be written, and develop content. If a major press conference is being planned there is also a need to reserve a venue early — high-profile locations like large rooms at the National Press Club can book out months to a year in advance. Preparing high-quality graphics and animations may also take several months. Rehearsals for a press conference should also begin at least one month before the event.

> "PIOs should ensure that all of the science teams understand the timing and know they cannot talk about the news with reporters or the outside public ahead of time, via Twitter, phone or other means"

It is also important for PIOs to sensitize scientists they work with ahead of time about the time needed to develop products, and to encourage them to let PIOs know of significant upcoming results as soon as possible. When a researcher is considering sending a paper for peer review, the draft should already be in the hands of the PIOs. For major announcements that will require press conferences, the researcher should first reach out to the PIO well before the data is compiled. The PIO should be well informed as the research phase draws to a close.

The actual news announcement should coincide with the acceptance of a peer-reviewed paper. Peer review establishes credibility for the findings — critical for historic research results — and the publication receiving the paper can help establish timing for announcements and help enforce the rules that ensure content does not leak before an announcement date. The press and science teams should work closely with the journal(s) to establish a schedule and embargo policies. Different journals have different embargo policies, and most will adapt their policies for big news items (more on embargoes below).

A media advisory announcing a news conference should ideally be sent out approximately three days before the event. Any longer and the risk of an embargo break increases, any shorter and reporters will not have enough time to prepare, from learning about the science to arranging for travel. The media advisory — which should not spell out the news, but only tease the event — itself generates buzz and at times speculation, which is a side-effect that may be hard to avoid.

The PIOs should ensure that all of the science teams understand the timing and know they cannot talk about the news with reporters or the public ahead of time, via Twitter, phone or other means. Experience shows that journalists will make cold calls to unsuspecting scientists and cleverly pitch half-substantiated rumors in the hope that someone will follow their scientific instinct and explain the correct version of events.

Embargoes

At the Multi-Messenger/Time-Domain Astronomy Summit, the PIOs and journalists discussed the best strategies for media embargoes. At the heart of the issue lies the question of whether journalists should be allowed advance copies of news releases and journal papers, and offered interviews ahead of an embargo date and time. For large media events, the embargo or publication date is set by the study journal working together with the organizers of the event.

Journalists have repeatedly expressed to PIOs (see, e.g., Sandu & Christensen, 2011) that having materials ahead of time is crucial because it gives them time to research and digest complex scientific topics

and to write more accurate and compelling stories. However, this must be weighed against the risk of an embargo break and eventually, a choice has to be made. An embargo break will negatively affect the overall media campaign by disrupting many of the time-consuming plans laid out in this document. A broken embargo negatively affects the impact of a planned news conference, undermining the months of planning, and the news becomes "old" by the time of the event, limiting press coverage; one or two experts and media outlets tend to gain all of the attention, and the public conversation tends to get confused and grows inaccurate and incomplete, never fully correcting itself. Containing an embargo break is even more difficult with large, international astronomy projects, and today, now that the boundary between a journalist and "someone who just posts on social media with a large following" has been blurred, embargoes are even harder to maintain.

A common strategy with regard to embargo policy and how to deal with media requests must be defined and strictly followed by all partners. A detailed justification for this strategy should be provided — both for collaboration members and the media — including the need to prevent accidental leaks, and avoid favouring individual media outlets.

Overall, an "all or nothing" approach to embargoes is best. All trusted reporters receive materials in advance, or none receive the materials if the risk of an embargo break is deemed to be too high. Picking favorites among reporters can mire a collaboration in controversy for years after an announcement, hurting overall media exposure and harming relationships with those who would otherwise be messengers for a wide range of future research results.

In the case of a global multi-institutional media campaign, such as those conducted by LIGO and the EHT, the "nothing" approach is best. This prevents embargo breaks and ensures fair and uniform access for all reporters. For news results that are not at the level of LIGO's and EHT's, and less likely to be leaked, the "all" approach can be beneficial and lead to increased media coverage. The American Astronomical Society and the American Association for the Advancement of Science's EurekAlert have been sending out embargoed news releases to a few thousand "trusted" reporters for decades, and have strict and clear adherence systems in place to address malfeasance. Furthermore, if leaks occur — and some do — through accidental online publishing mistakes, then PIOs can quickly work with media outlets to have the stories taken down. Sometimes, these efforts are not enough and the journal will have to lift their embargo earlier than planned. In these rare cases, journalists who leaked content are removed from media lists and lose privileges to embargoed materials in the future.

News Conferences

A large news conference — or more common now, simultaneous news conferences in different countries — can require more than a year of planning. One of the first steps is to determine locations. LIGO's two major news conferences were sponsored by the NSF. However, NSF headquarters in Arlington, Virginia, was not large enough to accommodate the expected press presence and space was rented at the National Press Club in Washington D.C. For the first announcement, the main news conference room was designed to hold 200 people and a similarly large overflow room where the news conference was streamed was also reserved.

The main room should be primarily for reporters with priority seating. The primary role of communication is to engage the audience, and reporters are the main conduit to reach that audience. If reporters do not have preferential access to the speakers and stage or are not allowed to ask all of their questions early in a press conference, they will not be able to do their job — and some will carry that negative experience with them and take it into consideration when weighing future coverage. Project VIP guests, such as government/agency officials, may be given premier seats, but should be limited depending on available space: the reporters are the primary audience.

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The venue should provide enough space to include at least the core members of the research team in addition to the few individuals who will be on stage. For the NSF EHT press conference and LIGO press conferences, reporters conducted the vast majority of interviews after the event cameras were turned off, engaging dozens of research team members, from project founders to graduate students. Not only is this critical to sharing the many stories beyond the main story arc, but this also addresses a need for the audience: there are more reporters in the room than available experts, and the reporters must get interviews to develop their articles.

The task of letting a project team know that many of its key members cannot attend the live news conference is challenging but necessary; it is, of course, understandable that they would all want to be present for such a momentous occasion. The PIOs must convey that the purpose of the news conference is to clearly communicate the results to reporters and the public, many of whom will view the event remotely. It is recommended that projects consider holding a separate celebratory event after the news conference to also serve other more team-building purposes. An overflow room for the news conference may also be reserved to handle selected team members and their families. Coordinated satellite events at facility or university locations are also a powerful way to expand the event's impact. Building upon the preceding core press conferences, such events showcase more of the research team for regional reporters, regional politicians, and members of the local community, creating "life moments" for the audience and strengthening ties between the community and the research institution.

Panel Composition

A news conference should have no more than five speakers, ideally three or four, and one moderator. Having too many speakers increases the risk of message points being lost or duplicated, and means that the overall presentation of the material may become muddied and disorganized. Additionally, viewer statistics for press conferences show a clear drop in audience as a press conference drags on beyond 30 or 45 minutes or grows too complicated. The goal of the news conference is to engage the audience with a compelling narrative and a clear description of the results. This will help reporters tell more accurate and emotional stories and will create a more enjoyable show for the viewing public watching from afar. An engaging news conference will also boost both morale for the team and public interest in the project. The best press conferences attract viewers even years after they post online.

Special care should be taken to ensure diversity on the panel by having a gender balance and including underrepresented minorities, striving to reflect the situation in society. Diversity is essential to bringing new perspectives and approaches to research, driving creativity, and preventing research fields from stagnating; all viewpoints are crucial to the future of science and society.

If a senior person is not included on a panel, and the project feels it is important for that person to be included in the press efforts, then alternative outreach strategies can be developed. For example: PIOs may produce targeted web materials such as video content, Q&As and background factsheets; funders may hold briefings for political leadership; weeks of continuing social media posts can incorporate other scientists' stories; and pitches to the media can highlight specific contributions that drove the science forward. Senior project members may also be seated in the audience at the front so that reporters' questions can be directed at them. There are a wide range of options to broaden exposure: in light of interest on Capitol Hill, NSF brought EHT scientists to two briefings for members and staff, one of which included scientists not involved with the original press conference.

More details about press conferences are in Fienberg (2019b).

Fig. 4: EHT press conference in Washington D.C. Credit: NSF.

Content

The news conference content should be simple and streamlined, and targeted at a general audience. Some reporters in the audience will have a deeper understanding of the field, but other reporters will not, and many members of the public watching remotely will be hearing concepts and terms for the first time. Moreover, even reporters from more technical outlets will benefit from a clear presentation of the materials.

The news should be presented at the start of the news conference, either by the moderator or the first speaker, with few or no welcome remarks (known as the inverted pyramid of journalism). Reporters generally see welcome remarks as a negative unless they convey important context for what is to come. Any remarks prior to the announcement of the finding should be brief — on the scale of one to five minutes: anything longer and the online audience will disengage. It is important to remember that for major press conferences, the vast majority of audience members — in some cases more than 99.999% — will not be on site, including reporters from some of the major news outlets. Those individuals are free to disengage for any distraction: do not provide them with a reason to leave.

Presenting the news at the start helps the public watching remotely engage with the material and helps reporters begin to formulate their stories for their readers. Other factors to consider in preparing content include:

- Each talk should be no more than seven minutes — and no more than five minutes if a full panel of five speakers is presenting. Reporters will want to quickly (at the latest around the 30-minute mark) get to the question-and-answer period so they can better frame the content for their audiences.
- Including an outside expert who is not on the project to speak at the end of the presentations helps offer a broader perspective on the results

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and tie the previous talks together. However, having an outside expert is not always possible given the limited number of panel seats and the large number of people involved in these types of projects. But it is always helpful to have outside experts available in the press conference room for reporters.

- Media training for the panelists is a necessity. University and federal agency PIOs, as well as professional companies, specialize in training scientists to present material clearly, without jargon and in ways that enliven the news. These training sessions also teach scientists how to conduct themselves in interviews with a focus on appropriately answering challenging questions and steering interviews back to the crafted message points. Training the panelists to develop sound bites for the media — captivating or colorful quotes that are likely to get picked up by the media — is also valuable. This video example from the New York Times coverage of LIGO's 2016 news conference, shows how various sound bites are highlighted from several panelists.

- The various PIOs involved should help develop a handful of message points for the news conference, and organize the content to start with the news, then back up to tell a story. The presentations should be put into the same (agreed) format, and edited for clarity and simplicity by a professional communicator (also see Fienberg, 2019c).

- The news conference should be engaging. For LIGO's 2016 news conference, it was important to have a moment of free expression and allow for cheering when the news was announced. PIOs worked with LIGO Laboratory Executive Director, David Reitze to create a sentence packed with emotion to deliver the news. His "We Did it!" exclamation was picked up by several media outlets (see link above). Props help viewers relate to and better understand the information being presented. An example from LIGO's 2017 news conference on the detection of both gravitational waves and light from a single cosmic event occurred when David Reitze held up his great grandfather's old golden chain watch and said, "*The gold in this watch was very likely produced in the collision of two neutron stars approximately a billion years ago*." Another good example occurred at NSF's EHT press conference in 2019 when Dan Marrone held up a large computer hard drive to convey the vast amount of data needed to process the first image of a black hole. He paired that with an explanation of how much data was processed, comparing it to the entire selfie image collection, over a lifetime, for 40,000 people. Another helpful action is to help the scientists prepare one or two compelling anecdotes that illustrate the enormous work and achievement of the collaboration or the global aspect of the teamwork and result. For instance, the EHT-anecdote about the hard drives with data from the South Pole Telescope that could only be collected once the Antarctic winter was over.

- Rehearsals are a crucial aspect of preparing scientists for news conferences. LIGO's 2016 news conference in D.C. involved five rehearsals, three over the phone and two in person. Rehearsal prep was similar for the LIGO 2017 press conference and the NSF EHT press conference. Of the six times the LIGO panelists presented the results, the live event was, as one might expect, the most compelling. The rehearsals helped the panelists refine their remarks and clarify how they each fit into the story arc, and helped them feel comfortable with the material so they did not have to follow a script and could speak more naturally.

- Involving a science imaging and illustration expert for the project is essential, and in addition to hired professionals, many institutions have full-time staff who can create multimedia content. Beautiful, explanatory

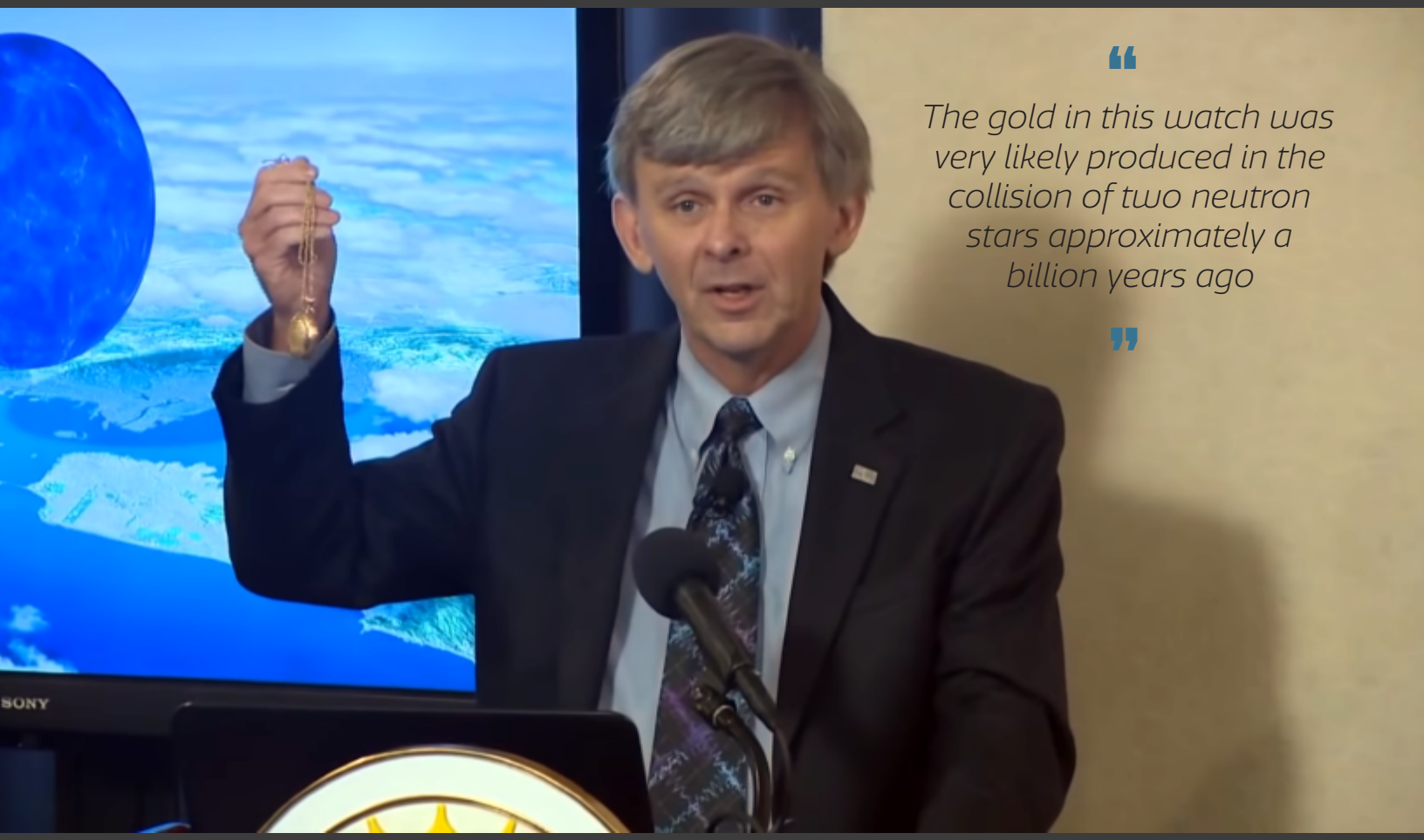


Fig 5: "The gold in this watch was very likely produced in the collision of two neutron stars approximately a billion years ago". *David Reitze referencing his great grandfather's gold watch in the 2018 LIGO press event on the detection of both gravitational waves and light from a single cosmic event. Credit: LIGO/NSF.*

graphics and videos draw viewers into the story, and are a fundamental component of news articles; the best images and videos get tremendous exposure in the press. Slides should contain minimal text, for essential labels only. Unlike what scientists typically present at science conferences, the graphics should not be slides using bullet points, but engaging visuals that are explained verbally. This helps viewers understand the material and presents well on televised or live stream broadcasts.

- News conference panelists should limit the number of "thank yous" and acknowledgements during their talks, preferably only offering a broad acknowledgement to the team or subteam. The target audience is the media and the public, not team members, and time is limited. The heroes of the story are the project and the science, not any team members. When possible, credit should be seen as belonging to the broader effort, with individual stories being told in the many content products that accompany the press conference.

Read more advice for press conferences in Fienberg (2020a).

Event Live Streaming

The public has a great appetite for listening to major science news conferences. NASA has for years broadcast news conferences to the public through their NASA TV channel and website, but other organizations do not always have the budgets for these types of broadcasts. Now, with the increase in bandwidth and popularity of live streaming video platforms such as YouTube and Vimeo, it is possible for institutions to share their press events remotely, not only with reporters but also with the public. Generally, the ability to ask questions remotely at an event is reserved for reporters, but live chats can be organized for the public as well, in which a team member is on hand to answer questions.

At NSF's LIGO 2016 and 2017 news conferences, a live streaming feed was set up by the agency in collaboration with staff from the National Press Club where the event was held. The press club feed was primarily for reporters, but NSF also streamed to YouTube for all to watch and, for EHT, shared in real time on NSF's Facebook platform using Facebook Live. This Facebook live stream had almost as many viewers as the YouTube simulcast. During the 2016 LIGO news conference, the YouTube feed had about 90,000 simultaneous views. By the end of the weekend, the YouTube broadcast had received about 500,000 views[1].

The YouTube video of NSF's EHT press conference at the National Press Club has been watched more than 1.3 million times and brought more than 17,000 subscribers to the agency's YouTube channel, while NSF's simulcast on Facebook Live reached 1.9 million people and brought more than 25,000 new followers to NSF's Facebook platform. NSF's Tweet of the image generated more than 5.4 million impressions and 750,000 engagements in the days after the event, and EHT activity drew 40,000 new followers to NSF's Instagram platform.

The concurrent EHT press conference YouTube stream from the European Research Council was seen by more than 3.1 million viewers and had 13.6 million impressions, 72,000 shares, 62,900 interactions, 58,000 likes and 1,600 comments.

When planning for live stream events, it is important to overestimate the number of possible viewers and plan accordingly so that servers can handle the extra loads. During the planning of the 2016 LIGO event, the team estimated that they would need space for no more than 10,000 viewers; however, a decision was made to increase the capacity just in case — a decision that proved to be crucial. Using "commercial-grade" video streaming and distribution platforms like YouTube also mitigates the risk of server meltdowns.

[1] Note that the video was taken down and put back up so the number of views currently listed does not reflect the full tally.

Organizing Interviews

With hundreds of team members spread across the globe, specific plans should be made for handling interview requests from the media. In situations where embargoed interviews are not set up in advance, the number of interview requests that come in shortly after a major news announcement can be overwhelming. A plan should be put in place ahead of time for how to distribute the requests to ensure fair representation of project members and inclusion of team members who reflect the diversity of the audience, including women, underrepresented minorities, and young people. One strategy used by the LIGO press team was to have the PIOs and scientists in one large conference room to help distribute requests as they came in by phone and email after the news conference. Having the PIOs in one room increases internal communication so that interview requests can be handled more efficiently.

In many cases, team members will not all be in one location. It is advantageous to have one lead PIO to keep track of incoming requests and assign new requests to different PIOs at participating institutes. Individual institutions will also separately pitch to regional reporters and others with whom they have established relationships (and sometimes a shared language). A unified tracking system, such as a Google spreadsheet, is essential to list and mark off interview requests as they are completed. Scientists should also be trained to let their relevant PIO know when they have done interviews so that the institution can track — or prepare to respond to — the published news story.

Prior to a news conference, a contact sheet should be made with the names of all the scientists available for interviews and other details to include contact information, location, area of expertise, hometowns, and languages spoken.

The goal is to set up as many interview requests as possible from all types of outlets, both big and small. For media sites or podcasts with smaller audiences, graduate students and other less-experienced team members can be used; it is good practice for them, and helps with fulfilling what is typically a huge number of interview requests.

Remember: the press conference starts the conversation. The international story that results is not limited in scope and duration if you remain engaged and regularly bring fresh perspectives to the audience.

News Releases

The backbone of a campaign for a scientific result is a news release with a captivating and dramatic story and an appealing main visual. Naturally, the quality of the communication products, the teasing social media campaign, and the collective might of dozens of world-leading organizations are important, but "content remains king".

The scientific importance of a story in itself does not guarantee newsworthiness. A news release has to cater to the needs of reporters, not necessarily the needs of organizations, agencies, and institutions. Fienberg (2020b) and Christensen (2007) have lists of newsworthiness criteria.

The goal of the news release is similar to that of the news conference: to simply and clearly explain the science results, and to provide reporters with factual information they need to write their own stories. It is not supposed to explain all the facts, nor serve as an opportunity for team members to get visibility. Quotes are more likely to get picked up in the media if they are concise (a short sentence), catchy, conversational or personal, and use vivid, emotional language. As is the case with news conference speakers, it is vital to include quotes from women and minorities so that a broad spectrum of the audience recognizes that they, too, can participate in these discoveries. The number of people quoted in a

news release should be limited — five at most — and the total length of the release should be fewer than 1000 words. In contrast to e.g. articles in magazines, news releases are quite formulaic if not even boring (for more details see Fienberg (2019a) and Christensen (2007)).

Deciding on which team members are quoted in a release can be particularly tricky when it comes to large scientific collaborations. There are hundreds if not thousands of contributing partners who all deserve credit for their efforts.

> "The goal of the news release is similar to that of the news conference: to simply and clearly explain the science results, and to provide reporters with factual information they need to write their own stories"

One strategy to help spread the wealth of team members is to have the different institutions and funding agencies involved prepare their own releases. This enables institutions to put their people out in front of their own regional media outlets — which can have long-term benefits in the local community, including with city, state, and Congressional/Parliamentary representatives — and gives reporters a wider array of people to quote. Journalists have expressed to PIOs that they like seeing variation in the news releases coming out from partner institutions — but to a limit. Some journalists have said that they will read about three or four news releases, and then ignore subsequent news releases after that.

With results like those from LIGO's first big news announcement in 2016 dozens of similar news releases were sent out from the AAS press list. In 2019 AAS sent out around 20 press releases for the first EHT result which were just a fraction of the total estimated 40–50 press releases produced. With this number of press releases how do PIOs avoid overwhelming reporters? The answer is not clear, but we advocate that one main, core release is developed with agreed branding, boilerplates and science messages, and then shared with partners for localizing with their own angles and quotes. We do not think all institutions need to adopt the exact same language; instead, the partners can target their stories to their local outlets. In these additional releases, the news can be summarized briefly up top, followed by a list of local experts and quotes. The core press release should be designed so that the many partner institutions can add elements relevant to their contributions.

Developing the News Release Content and Reviews

Before the main release for an event is developed, it is helpful for the key PIOs and science team members to create a handful of message points. These message points can be shared with other partners to help in developing materials and they can also be used when preparing team members for interviews and news conferences.

It should also be decided ahead of time who is writing the main release and who is reviewing it. A line has to be drawn between involving a sufficient number of people to expose all important issues and develop creative ideas, and having too many reviewers, leading to "too many cooks" or "writing a press release by committee", when the content of a release becomes jumbled and hard to read. A small "essential review team" should be agreed upon who will ultimately sign off on the final text and will help curate comments from multiple team members. The news release should not be shared widely with dozens or hundreds of partners for review, but can be shared once the essential review team has signed it off. Finally, the writer of the release and their newsroom editors should have control over the writing style of the release to ensure that it reads smoothly, avoids passive voice, and is easily digestible for the public and reporters.

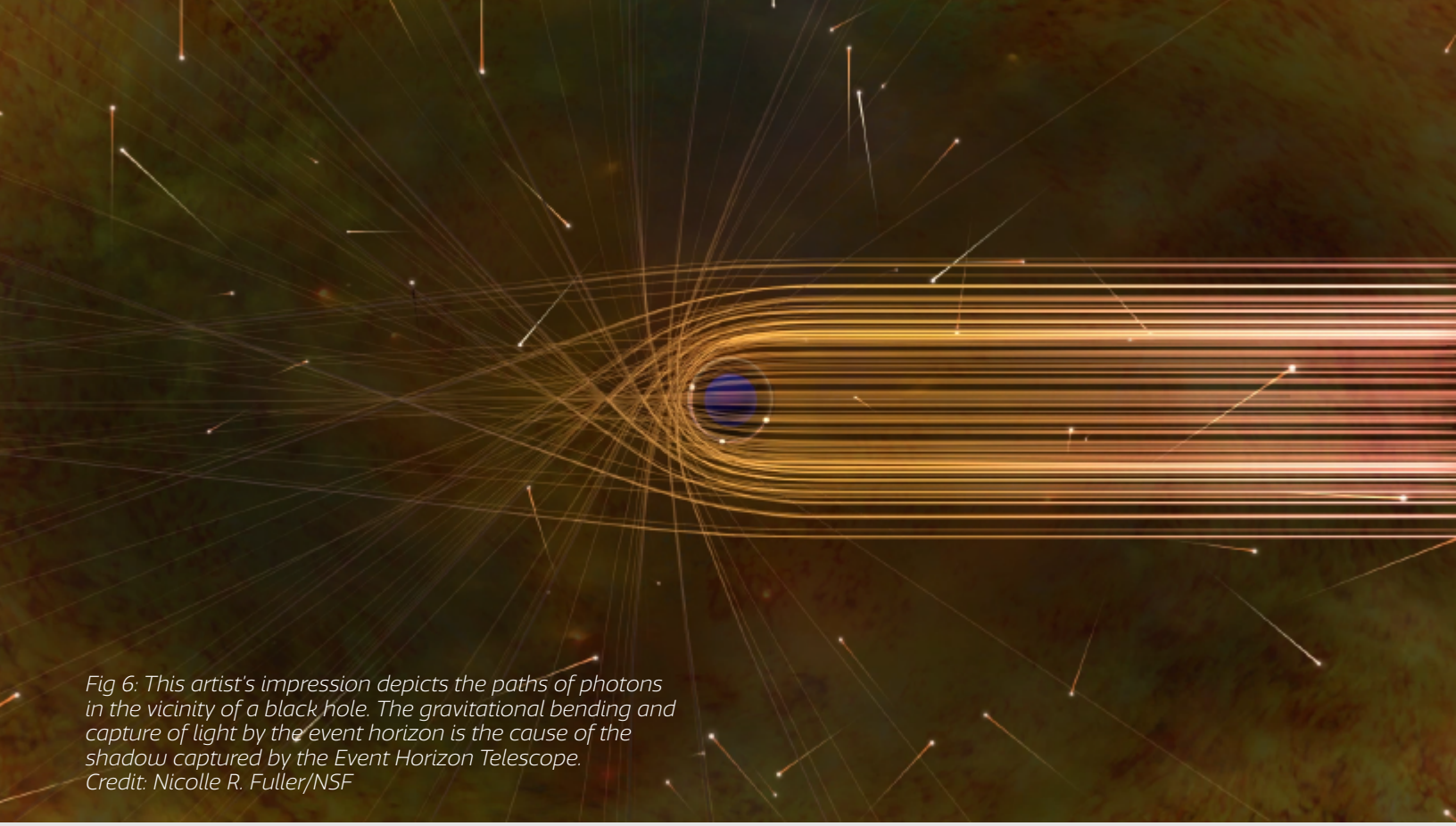


Fig 6: This artist's impression depicts the paths of photons in the vicinity of a black hole. The gravitational bending and capture of light by the event horizon is the cause of the shadow captured by the Event Horizon Telescope. Credit: Nicolle R. Fuller/NSF

Graphics and Video

Professional graphics, animation, and video are pivotal and can greatly enhance the amount and quality of media coverage received for a science result. Colorful, uncluttered information and engaging images and illustrations help attract audiences who might not otherwise follow science stories, and can help explain aspects of results better than can be achieved with text alone, thereby improving public understanding of science.

For many multi-institutional press events, for instance the EHT event, graphics were shared across teams on a joint collaborative platform — even across continents — to be incorporated into multiple products. Some graphics, such as footage of telescopes and explanatory illustrations, continue to get wide exposure and re-use even years after an announcement.

Elements of visual packages to consider include:

- Graphics that visually explain concepts that are difficult to understand with text alone;
- Pooling of resources from all partners to come up with a repository of graphics;
- Development of packaged videos, interview clips, and B-roll (supplemental footage intercut with the main shot for broadcasters);
- Availability of high-resolution materials and videos on multiple websites, and versions of images without labels (media outlets usually want to add their own labels).

In addition to the usual news releases and graphics, many other supplementary products should be included in an overall news package, including backgrounders, Q&As with team members, fact sheets, blog posts, and video interviews.

All visual materials need to be fully cleared under the most open distribution license possible, e.g. Creative Commons Attribution, and be available in the highest resolution and lowest compression possible so that they can be pooled and shared amongst all the partners.

Social Media

Communication issues related to social media are especially critical and complex for large multi-institutional media announcements. Social media story leaks can happen at any time, from announcements of initial observations and triggers to embargo leaks prior to media events. Additionally, "experts" who lack true expertise or are not involved in the embargoed research abound in social media circles and can impact timing, messaging, and accuracy of information disseminated prior to an official announcement. Even after an announcement's embargo ends, external social media posts can be wildly inaccurate and developing a plan to mitigate this is an important part of a large event's communication plan. This unfortunate scenario has happened, and damaged the outreach effort and the scientific results' long-term impact on public understanding and broader discourse.

> "It is recommended that all facilities likely to participate in a large, multi-facility discovery implement staff social media posting policies"

An especially critical, and often overlooked, phase for multi-institutional science announcements is during the discovery and observational period when multiple facilities are making observations to verify or characterize a discovery. In many cases, an astronomical telegram is issued as a trigger to initiate networks of facilities that will perform follow-up observations. During this phase, an innocent tweet or social media post by a facility's staff about an observation can jeopardize all future communications. Furthermore, astronomical "telegrams" are in the public domain and can spur speculation on social media. Staff may be inclined to respond and this can lead to conversations spiraling out of control if not anticipated and managed correctly.

It is recommended that all facilities likely to participate in a large, multi-facility discovery implement staff social media posting policies. The policy should prohibit any posting of potentially sensitive information on ongoing observations,

Fig 7: Some of the EHT posts went viral and took on a life of their own. Courtesy of Michael Moyer.

on both institutional and individual social media channels. This should apply to Principal Investigators as well as staff in order to lessen the chance of an early leak of the discovery and subsequent speculation by social media influencers, bloggers etc.

During the lead-up to a large multi-institutional press event, an increasing number of individuals will be privy to specific information on the finding and it will become increasingly likely that a mention could be made on social media. It is of paramount importance that all participants and associated staff are informed of the risks inherent in social media posts and the inadvertent breaking of an embargo by internal participants. In these cases, it is advised that all individuals involved in the logistics and production of media resources receive a clear statement/policy on personal social media posts and the risks to the communications process that a leak would impart.

During a press event/announcement all social media from participating facilities should be coordinated in advance in order to unify timing and messaging. With social media, not only does coordination improve messaging, it can dictate the impact of outreach. Search engines are constantly looking for trending topics, and the best way to trend is for a wide number of trusted international institutions to be talking about the same thing at the same time. It is recommended that there be a single social media coordinator or manager to coordinate social media posts in advance. This coordinator/manager role should be streamlined by limiting it to one key individual coordinator with 1–2 deputies distributed across as many time zones as possible for 24-hour coverage leading up to the announcement. It can be advantageous to gather a team of (younger) scientists who can answer questions in real time on social media, and be available to give interviews and extra provide information.

All institutional social media posts should be produced in advance, hashtags agreed, messages translated as needed and coordinated through the above-mentioned social media coordinator/manager. This position requires a substantial amount of effort and resources need to be allocated appropriately, and well in advance, to avoid system overload in the days surrounding the announcement event.

To summarize, a social media plan should include:

1) Assignment of social media lead and deputies;
2) Policies for staff social media posting regarding discoveries and follow-up observations;
3) Clear chain of command for social media posts and interactions;
4) Identification of platforms to be used;
5) Identification and assignment of social media contacts at each facility involved in the announcement;
6) Development of draft template posts with visuals;
7) Translation.

Advance scheduling (Hootsuite or similar scheduler) of posts with coordination among involved facilities/institutions.

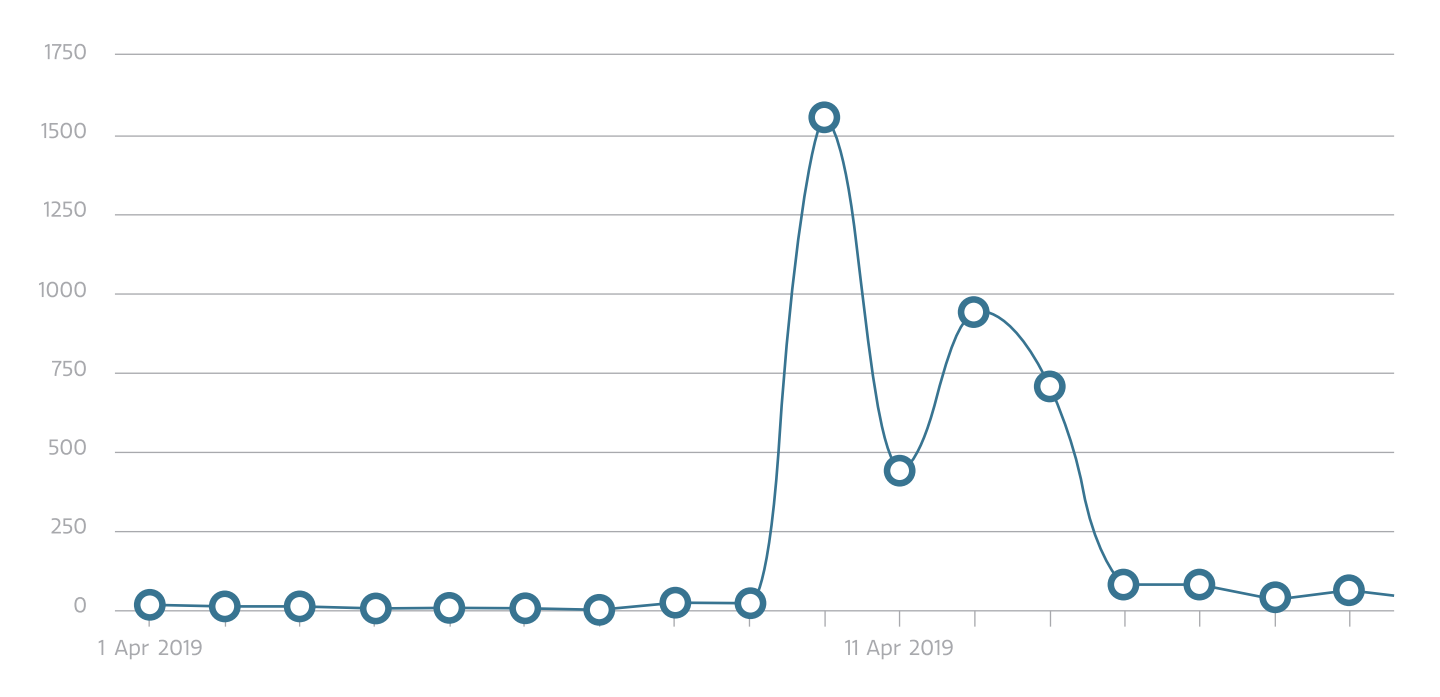
Even with the best planning, the outcome of a campaign cannot always be predicted in a world heavily influenced by rapid-fire social media and fake news. Unpredictable viral side stories can take on lives of their own and can help the visibility of the main storyline (Christensen, 2019). A plan should be implemented for monitoring and responding to social media coverage of significant results, especially concerning scientists with large numbers of followers or enhanced name recognition.

Metrics

The use of media tracking services for traditional, electronic, and social media is needed to determine the impact of the story (funding agencies and governing bodies love data) and justifying the level of effort by the institutions involved. Generally, one or more of the organizations involved in the research will subscribe to a tracking service (e.g., Meltwater, Cision etc.) but results might be limited to their organization's tags. In some cases a simple web search can also be meaningful (and inexpensive), and should be done regularly for at least a week after the release to spot trends and longer-term impact of the story.

Important metrics include theoretical readership (in number of readers or equivalent advertising value, EAV), number of press clippings, social media reach, web visits, and engagement.

As an example, the theoretical EHT global readership was on the order of billions, possibly as much as 4.5 billion (established independently with two measures, including Cision). Such theoretical readership numbers are naturally only indicative and should be used with caution and significant caveats. The result trended as number one on Twitter globally, reached the top spot on Google News, got its own Google Doodle, and was the most popular story ever published for many of the scientific organizations involved.



A plot showing Event Horizon Telescope press clippings with time related to JCMT and SMA. The second bump in the graph is due to the separate announcement of Pōwehi as the Hawaiian name assigned to the object. Credit: Bennet Group/JCMT

Conclusions

Astronomy is a discipline that has, throughout history, relied on the collaborative efforts of teams of scientists and engineers. Today, as observatories on the ground and in space become larger and more complex, so too do the collaborations of scientists and engineers who build and use the facilities to carry out their research.

The chances are that the big discoveries of the future will be made by big-science infrastructures in big multi-institutional collaborations, and possibly increasingly in novel areas like Multi-Messenger and Time-Domain Astronomy.

With so many astronomy partners stretched around the globe, and so many varying levels of involvement and investment, the challenge of coordinated media campaigns, especially for big discoveries, is formidable and requires an advanced level of protocol and professionalism.

Coordinating a "big science" campaign can take months, and for larger international announcements, more than a year, and developing a media campaign for a large international astronomy collaboration requires a clear organizational hierarchy with an agreed communications plan and well-defined roles and responsibilities. Ideally, the astronomy collaboration presenting the results will have a full-time communications specialist, or Public Information Officer (PIO), who leads the press efforts in coordination with the many PIOs from the collaboration's various institutions and stakeholders. Additionally, key scientists on the project must be available who can speak with clarity and authority to both the public and fellow scientists in the collaboration. It is worth noting that the communicators do not own the scientific message, but manage issues of communication style, infrastructure, distribution, timing etc.

A common strategy with regard to embargo policy and how to deal with media requests must be defined and strictly followed by all partners. PIOs should ensure that all of the science teams understand the timing and know they cannot talk about the news with reporters or the outside public ahead of time, via Twitter, phone or other means. A detailed justification for this strategy should be provided — both for collaboration members and the media — including the need to prevent accidental leaks, and avoid favoring individual media outlets.

A news conference should have no more than five speakers, ideally three or four, and one moderator. Having too many speakers increases the risk of message points being lost or duplicated. Special care should be taken to ensure diversity on the panel by having a gender balance and including underrepresented minorities, striving to reflect the situation in society.

Media training for the press conference panelists is a necessity. University and federal agency PIOs, as well as professional companies, specialize in training scientists to present material clearly, without jargon and in ways that enliven the news.

The various PIOs involved should help develop a handful of message points for the news conference, and organize the content to start with the news, then back up to tell a story. The presentations should be put into the same (agreed) format, and edited for clarity and simplicity by a professional communicator.

With the increase in bandwidth and popularity of live streaming video platforms such as YouTube and Vimeo, it is possible for institutions to share their press events remotely, not only with reporters but also with the public, which can lead to millions of viewers.

A plan should be put in place ahead of time for how to distribute the interview requests to ensure fair representation of project members and inclusion of team members that reflect the diversity of the

audience, including women, underrepresented minorities, and young people.

The goal of a news release is similar to that of the news conference: to simply and clearly explain the science results, and to provide reporters with factual information they need to write their own stories. It is not supposed to explain all the facts, nor serve as an opportunity for team members to get visibility. One main, core press release should be developed with agreed branding, boilerplates and science messages, and then shared with partners for localizing with their own angles and quotes.

Professional graphics, animation, and video are pivotal and can greatly enhance the amount and quality of media coverage received for a science result. All visual materials need to be fully cleared under the most open distribution license possible, e.g., Creative Commons Attribution, and be available in the highest resolution and lowest compression possible so that they can be pooled and shared amongst all the partners ideally on a common collaborative platform.

Communication issues related to social media are especially critical and complex for large multi-institutional media announcements. All institutional social media posts should be produced in advance, translated as needed and coordinated through a social media coordinator/manager.

It is recommended that all facilities likely to participate in a large, multi-facility discovery implement and enforce staff social media posting policies.

References

- Christensen, L. L. *The Hands-On Guide for Science Communicators*, Springer, 2007
- Christensen, L. L. *et al.*, *An Unprecedented Global Communications Campaign for the Event Horizon Telescope First Black Hole Image*, CAPjournal 26, 2019
- Fienberg, R. 2019a *Press Releases in a Nutshell*, 2019
- Fienberg, R. 2019b *AAS Press Conferences in a Nutshell*, 2019
- Fienberg, R. 2019c *Presentation Slides in a Nutshell*, 2019
- Fienberg, R. 2020a *How AAS Press Conferences Happen*, retrieved 28 September 2020
- Fienberg, R. 2020b *What Makes an Astronomy Story Newsworthy?*, retrieved 28 September 2020
- Sandu, O., & Christensen, L. L. *ESO Media Poll 2011*, 2011