

Creating the Cosmos

Lynette Cook



My parents loved the outdoors, and I credit them for my own wonder of the natural world. Favorite memories include hunting for giant puffballs and spring flowers in the Southern Illinois woods. On camping trips my mother would point out the constellations, which seemed especially close and bright on a summer vacation to Canyonlands National Park in Utah. I felt as though I could reach out, grab the stars, and pull the sparkling gems down to Earth.

Given my aptitude and appreciation for art, it seemed fitting to become a scientific illustrator. A staff position of Artist/Photographer for the Morrison Planetarium, which I held from 1984-2000, was instrumental in connecting my art skills with astronomy. I have been privileged to work with research astronomers, science editors, and art directors, portraying the marvels of the universe visually: extrasolar planets, distant galaxies, black holes, possible life in the universe, and much more have been some of the wonderful places this work has allowed me to “visit.”

Much of my artwork is commissioned for announcements about cutting edge astronomical research. How exciting it is to know the news before it makes news, and to play a role in getting the word “out there.” This process is a mystery to many, and I often am asked the question, “How do you know what to paint?” To shed some light, I turn to my work with the Gemini Observatory, for which I’ve created numerous illustrations used in announcements identifying new discoveries.

From Discussion to Form

My most recent Gemini art was for the November 26, 2013 announcement titled “[Fast, Furious, Refined: Smaller Black Holes Can Eat Plenty.](#)”

It describes the environment around M101 ULX-1, and features a stellar-mass black hole with accretion disk and a Wolf-Rayet star that feeds the voracious appetite of the black hole.

As with many new ventures, artwork begins with brainstorming. Often the starting point is a conference call with Peter Michaud, the Public Information Outreach Manager at the Gemini Observatory, along with the Principle Investigators on the discovery team. In the case of M101 ULX-1 we relied on email communications since Stephen Justham and Ji-Feng Liu, the science contacts weighing in on the art, are with the Chinese Academy of

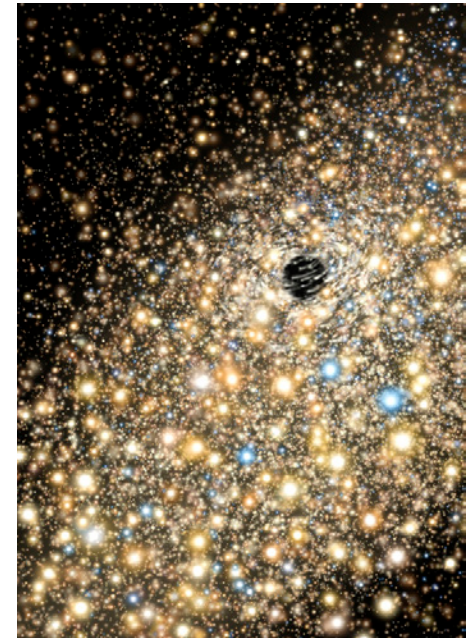
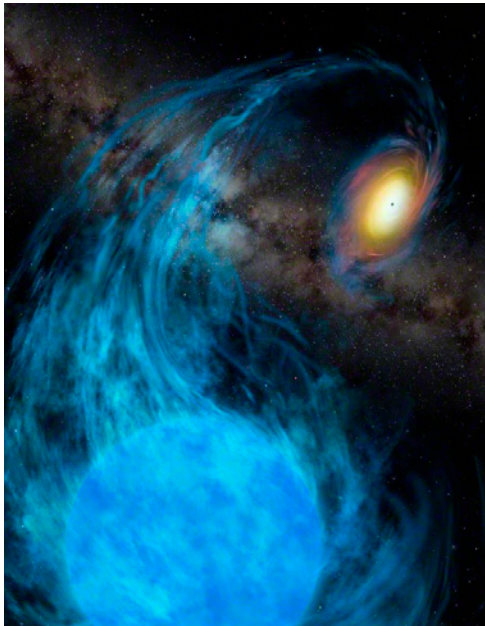
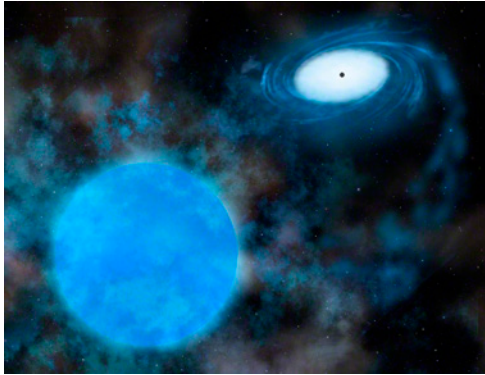


Figure 1. This supermassive black hole has nearly 10 billion times the mass of the Sun. It is located in NGC 4889, the brightest member of the Coma galaxy cluster. [[Gemini Observatory/AURA](#), artwork by Lynette Cook]



Figures 2 and 3. Rough mockups explore options for composition and color. [© Lynette Cook, all rights reserved.]

Sciences in Beijing, China and time zone differences were at play.

Peter and Stephen began the conversation by describing the M101 ULX-1 environment, specifying which objects needed to be shown in the art. We talked about the color, which often has little or no meaning in astronomical renderings, and size of the star, accretion disk, and gas stream. Also important was the overall “look” of the disk: whether it should appear thick and dense or thinner and less structured.

With key points in mind, I created several color mockups for the committee to review and discuss. Years ago I would have developed these “roughs” with graphite pencil on tracing paper or colored pencil on black mat board; today they are done digitally, low in resolution and unfinished in terms of detail, yet many steps closer to finished art than the simple mockups of yesteryear. The purpose is to show different compositions, orientations, and sizes of the main objects.

The committee then weighed in with comments and suggestions

for changes. In this case, a key decision was to put the black hole and disk in the foreground and the star in back. We discussed in greater depth how much material the black hole should be pulling away from the star, the likely trajectory, and appropriate colors. I then modified the roughs and invited another round of comments. This process repeated until we had one image that satisfied all the primary criteria.

With approval of the first step, I moved on to the high resolution file, fine tuning the details so the image would pass inspection when examined closely. This step takes the most time, as I zoom in and out and scroll around to tweak the “little stuff.” Regardless of how I create the various smaller components in an image, which can vary, I use Photoshop to composite all the main elements. This results in a file with many layers that becomes very large in size.

When I am satisfied, the process repeats: the committee weighs in again, more adjustments are made, and eventually all parties declare the image a “go.” At that time I send Peter a final high resolution file and my part is done.

Elsewhere, work continues behind the scenes. Peter pairs the illustration with the announcement text, writes a caption, and iterates with the astronomers on any remaining details. When finished, the final press release is distributed to the media with an embargo date,

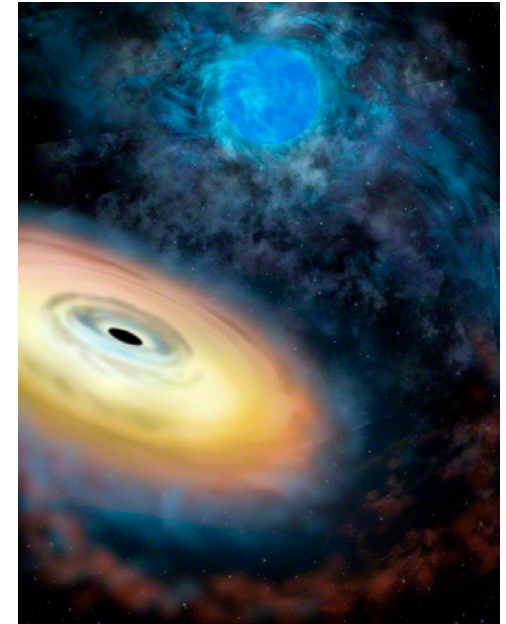


Figure 4. Several revisions into the process, the locations of the star and disc are switched and the structure and color of the disk are fleshed out further. [© Lynette Cook, all rights reserved.]



Figure 5. The finished M101 ULX-1 artwork, showing a horizontal format. The black hole was reduced in size and the inner disk was brightened. Further adjustments were made to the density of the stream's gas, the material blowing away from the star, and the coloration of the disk. [Gemini Observatory/AURA, artwork by Lynette Cook]

which means they have a “heads up” and may prepare their news stories but may not make it public until the embargo time and date arrive. Gemini’s web site is prepared and ready to go live at the exact moment the embargo lifts.

It’s all in the Timing

When the magic moment arrives the article and accompanying images can appear anywhere: online, in magazines, on the evening news, and in the next morning’s newspaper. The extent of the announcement’s reach is dependent upon how exciting the news is deemed to be, and how much other breaking news gets top billing. A politician’s indiscretions or movie star’s arrest might bump science off the front page, or off the evening news entirely.

Though I sometimes regret that the illustration world (both scientific and commercial) is largely computer-generated today, there is no question that digital art allows for faster turnaround, quicker changes, and more revisions than traditional media. And when it comes to illustrations for press releases, timing is everything. I have created art in as little as 48 hours or, when the pace was more relaxed, taken three weeks or more. The norm is about a week and a half. Figures 6 and 7 show two complex pieces that would have been nearly impossible to produce with traditional methods within the

time frame available, while also allowing for communications among committee members and several changes at both rough and high resolution stages.

It is a romantic notion to suppose that such projects are lined up in my studio at all times and that I whip them out in quick succession. In fact, they tend to come “out of the blue.” One week I might be spending a little time on Earth, so to speak, painting the Golden Gate Bridge for a San Francisco Bay Area art exhibit, and then an e-mail with an exclamation mark pops into my in-box with an extra loud “Ping!” Next thing I know, I am Velcroing myself

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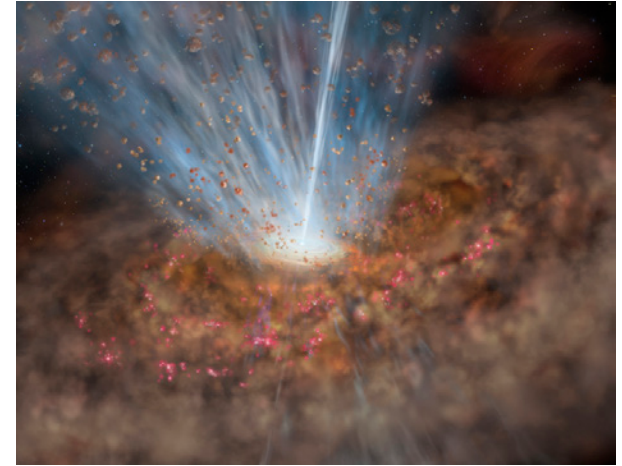


Figure 6. The supermassive black hole at the center of Mrk 231 has a broad outflow, shown here as the fan-shaped wedge at the top of the accretion disk. A similar outflow is probably present under the disk as well and is hinted at in this illustration. A more localized, narrower jet is included as well. [Gemini Observatory/AURA, artwork by Lynette Cook]



Figure 7. This rendering of W33A showing the accretion disk (yellow/orange), torus (dark ring around disk) and bi-polar outflow jets (blue) within the dense clouds of its stellar nursery. [Gemini Observatory/AURA, artwork by Lynette Cook]



Figure 8. Two Earth-sized bodies collide near HD 23514. [Gemini Observatory/AURA, artwork by Lynette Cook]

million year old star in the Pleiades star cluster. The star is very much like our Sun, though it is 45 times younger and is orbited by hundreds of thousands of times more dust, suggesting catastrophic collisions in an evolving young planetary system. While working on this art I felt I was aboard a time machine, transporting myself into the past to witness two planets crashing into each other, spewing chunks of rock.

Topping that, an Outer Limits mystery: the case of the TYC 8241 2652 system. Several years ago it had all the characteristics of solar system formation. Today, however, the warm dust thought to originate from collisions of rocky planets is nearly all gone. What happened to it? For this news article I developed two images that show the “before” and “after” views. These were provided [via the Observatory’s website as stills and also as an animation](#).

Communication is Key

It is said that “too many cooks spoil the broth.” This usually means that the more people in the mix when it comes to input and decision-making, the more complicated the process becomes (also the

to the computer to create an exoplanet or gamma ray burst, the embargo date looming large ahead of me.

Though each illustration is unique, some stand out as extra special. A case in point is the November 15, 2007 announcement about hot dust surrounding a 100

more diluted and tasteless the results). To my delight, however, those with whom I’ve worked on announcement artwork have been stellar (no pun intended). Narrowing in on the most important elements of the science and what needs to be shown — and communicating the finer details of size, color, texture, object relationships, and more — I’ve felt that these collaborations have gone exceedingly well, without the huge bumps in the road and frustrating impasses that can occur when individuals gather to move toward a common goal.

While good communication is necessary with Peter and the astronomers,

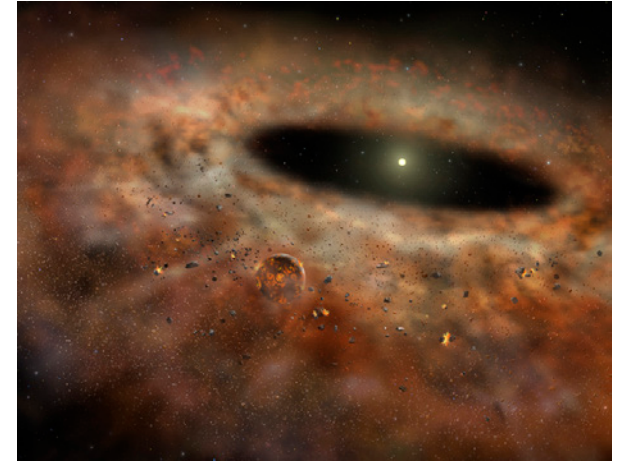


Figure 9. The dusty TYC 8241 2652 system as it might have appeared several years ago when it was emitting large amounts of excess infrared radiation. [Gemini Observatory/AURA artwork by Lynette Cook.]

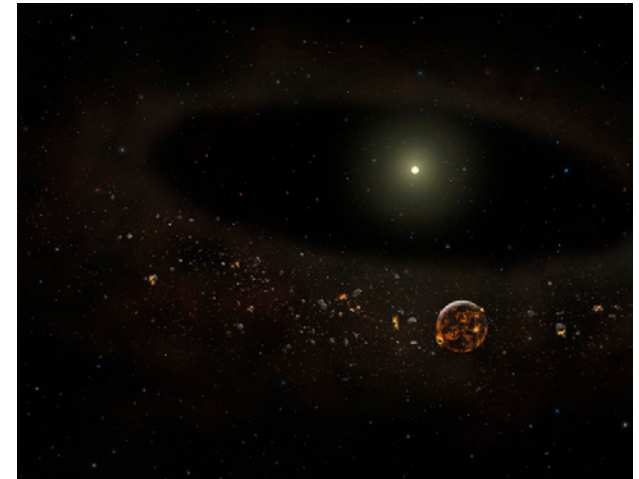


Figure 10. Most of the surrounding dust has disappeared — based on observations by the Gemini Observatory and other ground and space-based observatories. [Gemini Observatory/AURA artwork by Lynette Cook.]

as far as the rest of the world is concerned this process moves in secrecy. One mustn't spill the beans about a release before it's time. When someone outside our group asks what I am working on, I bite my tongue and reply with an answer that ranges from "Oh, nothing much" to "Just a 'star thing.'"

Recipe for Success

One process that can help reach the goal of creating successful art is to treasure hunt for existing photos and other imagery that might have a bearing on the new art. A prime example is using Voyager photos of Jupiter as a resource to depict exoplanets of several Jupiter masses. This said, no photo or existing art will be ideal, and this is exactly the point: I am illustrating something that has neither been seen nor illustrated before. And such fun it is to be a cosmic creator

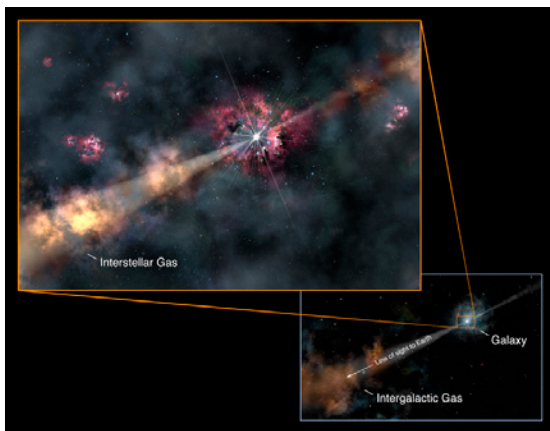


Figure 11. Visualizing objects and distances of great proportions was necessary for this artwork. It shows light from a gamma-ray burst passing through interstellar gas in its host galaxy (close-up view, left), and also through intergalactic gas positioned between the distant galaxy and Earth (wide view, right). Photographs of nebulae and star-forming regions were useful as references. [Gemini Observatory/AURA, artwork by Lynette Cook]

of this sort!

In my darkest hours, when my computer behaves badly or I have a question that only another artist can help with (say, how to get correct lighting on a planet's rings), there is a way to get input even when zipping my lip. The International Association of Astronomical Artists, of which I am a Fellow, is a group of talented and experienced individuals who love to paint space, both digitally and tradi-

Words from "The Other Side"

I invited Peter Michaud to share his priorities when interfacing with artists who create artwork for the Gemini Observatory. His words emphasize the need to maintain scientific integrity:

"When it comes to working with an astronomical artist or illustrator, it is absolutely necessary that they have a strong initial vision of the piece, but they must be able to meld that vision with that of the scientist. This isn't easy! Just as the writer falls in love with the words they write, and resists the advice of an editor, it is easy for an artist to fall in love with their creation and resist the changes necessary to make the work more accurate or more illustrative of the point being made."

"A successful image is, first and foremost, aesthetically pleasing. But, with that said it also has to reflect the reality of our understanding of the environment being illustrated. Balancing these two elements is often challenging and where the tension builds in the process of creating an effective astronomical illustration or piece of art. Finding creative solutions, and being willing to iterate, sometimes beyond what seems reasonable is what is often required. Producing a successful image requires patience!"

tionally. With members in several countries, usually someone is at the computer even in the wee hours of the night and can be queried for help. (For more information, see www.iaaa.org.)

I have not yet mentioned the groundbreaking "magic formula" that I use to create my astronomical art. Why? Because there isn't one. Nor have I provided a lengthy "nuts and bolts" discourse about the media, computers, software, and RAM that I use because, in the end, it doesn't matter. There are multiple paths to the same goal, including paint on paper, an old version of Photoshop, and a high end 3D software package. Creating a successful image takes basic (yet extensive) knowledge of composition, lighting, and color, plus masterful use of the tools chosen, regardless of whether these tools

are digital or traditional.

As I conclude, my mind flashes on a key point drilled into me as a science illustration student: that this career path is about artist/scientist collaborations in which each person on the team lends his/her expertise to create a new visual that informs and educates. This summarizes what the Gemini Observatory and I do together: we translate the scientific data into realistic visuals that enable others to experience the wonder of the universe for themselves. What could be more magical than this?

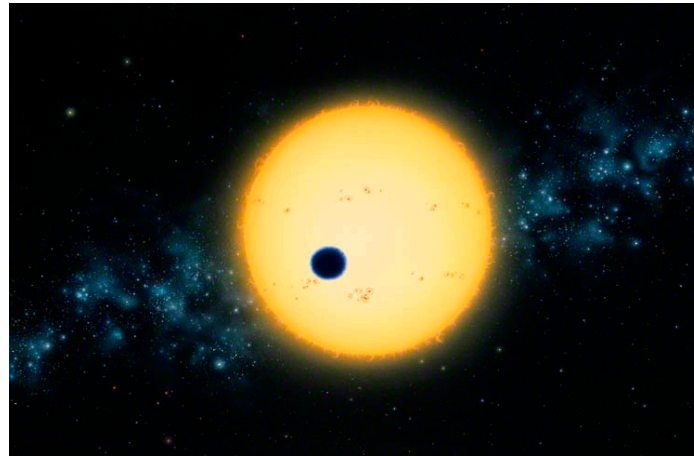


Figure 12. The Transit of HD209458, used in association with Geoff Marcy's press release in 1999, was created with acrylic, colored pencil, and gouache on illustration board. It generated an e-mail from a distant viewer asking what amazing image processing software I had used to get such a clear photo. [© Lynette Cook, all rights reserved.]

About the Author

Lynette Cook has illustrated the cosmos since the 1980s. An award-winning illustrator and painter, Lynette's art has appeared world-wide in books, periodicals, documentaries, and online articles. She also is a consultant for the NOVAS program (NASA Opportunities in Visualization, Art, and Science), which provides art/science workshops to teens in the San Francisco Bay Area. To see more of Lynette's artwork, go to www.lynettecCook.com. ✨



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