

ASTRONOMY FOR EVERYONE

The Story of *Look Up to the Stars*
by Kevin Manning, Astronomer & Lecturer



The beauty and majesty of a starry sky is awe-inspiring to the beholder; one must simply look up to see and wonder at its splendor. The universe, with its untold mysteries in the depths of space, has always been my laboratory. The jewels of the night sky march across this panorama with smooth and gracious transitions as the earth spins without compromise. The mystery and beauty of the universe creates an ideal topic to spark students' and library patrons' interest. To capture their attention, I use an array of photos as we tour these galaxies, learn of their origins, and contemplate what scientists are on the verge of discovering.

To help build awe-inspiring astronomy education, I founded Look Up to the Stars in 2004. Our mission is to generate interest and foster scientific literacy nationwide through the delivery of educational and entertaining astronomy programs.

This mission aligns with the goals of many libraries to make educational opportunities available and accessible to their communities, whether they are public libraries, academic libraries, or school media centers.

Since 2009, the International Year of Astronomy (IYA), I have offered our Star Tour Across America to individuals, families, schools, libraries, civic organizations, retirement communities, corporations, and churches. In 2009, IYA celebrated the 400th anniversary of Galileo Galilei and the first telescope with 100 nations around the world.



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Learning from Astronomy

As CEI Executive Director Christine Mason indicated in a recent blog for CEI (Mason, 2021), I follow a few basic principles when teaching children and adults. Whether your patrons participate in one of my programs, you work with local astronomers, or you host your own S.T.E.M. events, you can incorporate these strategies into your library programming:

1. Sophisticated subject matter can be shared with audiences of all ages. Astronomy is not only for high school or college students.
2. Hands-on activities help to make complex learning more concrete; many children and adults learn faster and remember more with an added kinesthetic component. When I work with youth, I often use kits so that they can build their own telescopes.
3. Tell stories and use metaphors or similes to compare the unknown to something knowable. For example, I compare black holes to water going down the drain. As you do this, let your own intrigue show – help students see that you are excited about this subject.
4. Use interesting videos or photos. My presentations give attendees a closer look at stars that are light years away.
5. Involve the community. Check out local astronomy clubs; members are often available to speak with classes or share lessons online.
6. Invite families to learn together. I offer classes not only for youth, but also for families, providing a forum for families to explore space together.
7. Take advantage of remarkable online resources. I use NASA's microobservatory to help students to take images of planets, galaxies, and nebulae.

Inspiration

Just as many have been inspired by Einstein's extensive discoveries, other scientists can serve as role models for all of us, including your patrons. While I have been inspired by several giants in the field, a celebratory symposium honoring [Dr. Vera Rubin](#) at the Carnegie Institute in Washington, DC, stands out as a moment in time that made a significant difference in my life.

Vera is a world premier astrophysicist who developed a procedure for identifying dark matter throughout the universe (Rubin, 1997). In a field dominated by male astronomers, Vera faced much criticism and opposition from her male counterparts as she battled to gain credibility. In fact, many feel that she was deprived of winning a well-deserved Nobel Prize.

Vera encouraged girls who were interested in investigating the universe to pursue their dreams, and was a force for greater recognition of women in the sciences and for scientific literacy. Role models like Vera can help challenge stereotypes and provide motivation when students are developing an interest in the field.



Going Virtual

While I have traveled the country for many years sharing my insights and love of astronomy, with the onset of Covid-19, I created a virtual astronomy experience for Look Up to the Stars.

This virtual experience includes fun hands-on activities, classes, programs, and camps about our awesome universe using Zoom, including:

- Virtual Astronomy & Space Academy
- Family Virtual Astronomy Programs
- Summer Astronomy Camp
- Individual, S.T.E.M.-based, hands-on activities

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One of the most popular all-ages family programs is Astronomy for Everyone: Size & Scale of the Universe. In this program, I explore different aspects of the universe from the very small subatomic particles to the very large superclusters of galaxies. It's a virtual journey throughout the cosmos describing celestial objects and how they were formed. Truly exciting images and video segments are used to illustrate the differences in their relative sizes. When this program is offered in person, participants also go outdoors to view celestial objects in the night sky through a powerful hand-crafted telescope, weather permitting. They can see wonders such as the ice crystal rings of Saturn or craters on the Moon. Participants who take the program in the daytime use a solar filter, like the one NASA uses, to view sunspots on the sun.

Making Cosmic Quilts: Using KWL and NASA's Microobservatory

As part of my work in astronomy education, I have been involved with creating professional development for teachers of varying grade levels and disciplines. In these workshops, I use an interdisciplinary approach, working with teachers on various skills from creating thematic units, to using alternative assessment strategies, such as rubrics and checklists, to facilitating collaborative learning for students. The following are some recommendations for activities from those workshops that can be adapted to a library setting:

- **K-W-L Charts:** Have students take ownership of their learning by filling in a K-W-L chart with "What they know" before the lesson, "What they want to know", and "What they learned" after the lesson.
- **NASA's MicroObservatory:** Students can use this online program to access robotic telescopes, take photographs of planets, galaxies, and nebulae and use image processing tools to bring out detail in these photos the same way that professional astronomers do.
- **Cosmic Quilts:** Your class can make a cosmic quilt by gathering images of a selected celestial object from different views and adding these to a quilt block. All students' blocks can be joined to form a cyber cosmic quilt. You can even make a physical quilt by printing the images onto fabric and sewing them together.

A Cosmic Quilt from 1876

Years after I began my workshops on building cosmic quilts, I discovered the story of a teacher from 1876 who handcrafted her own Solar System Quilt which she used when teaching astronomy to her class. Ellen Harding Baker spent up to seven years embroidering the whole solar system onto a quilt, and then used it as a visual aid during her lectures.

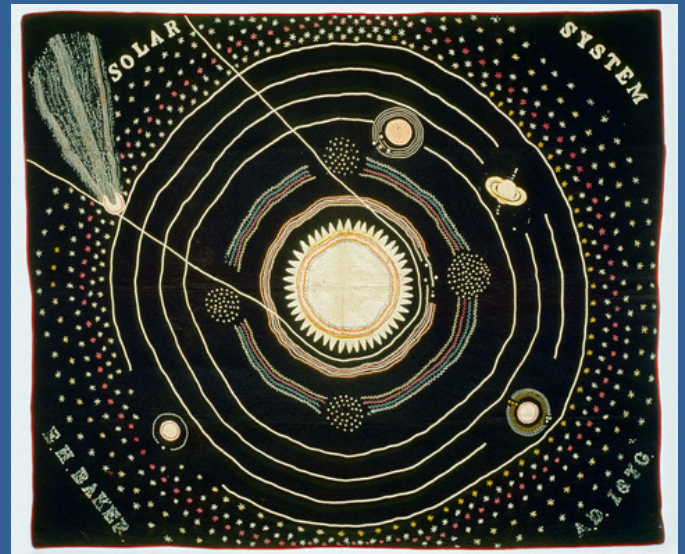


Photo courtesy the Smithsonian National Museum of American History.

The large black woolen quilt had a colorful wool-fabric appliqué and silk embroidery. It was nearly 7 ½ by 9 feet in size. The quilt was very detailed and included our Moon and other moons such as the moons orbiting Saturn, Uranus, and Neptune, and the Galilean satellites of Jupiter. Even solar system debris such as asteroids and a comet are illustrated, and distant stars are shown as small, stitched dots. The Smithsonian National Museum of American History now houses this famous teacher's tool.

Telescopes

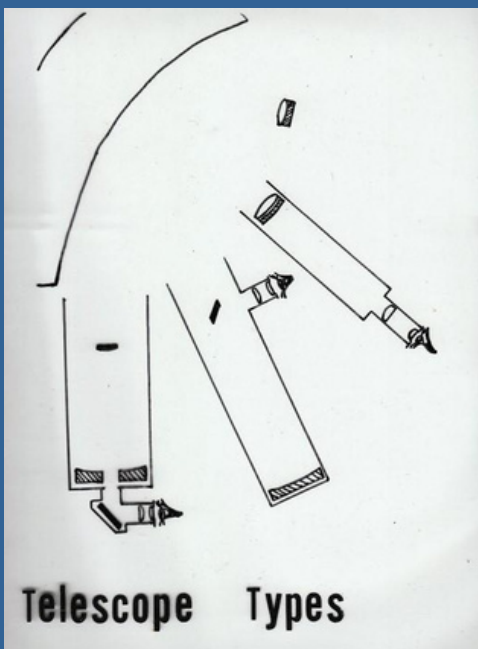
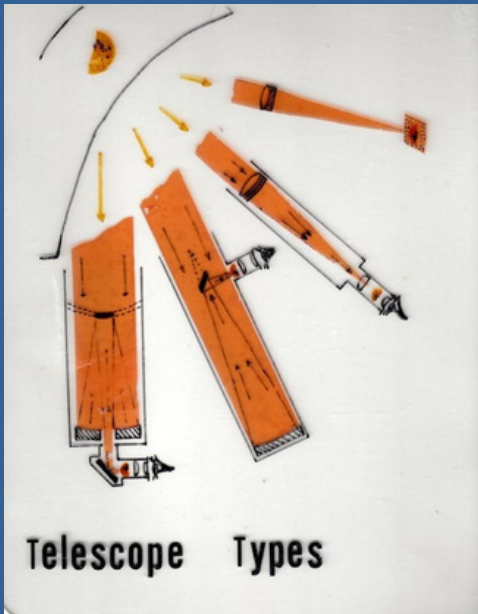
The telescope is the primary tool of the astronomer. It's a window to the stars. The New Hampshire Astronomical Society founded the Library Telescope program, first starting with two telescopes in 2008 and expanding nationally and internationally to provide hundreds of telescopes throughout public libraries. According to librarytelescope.org, nine libraries in Florida offer telescopes to their patrons.

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An effective telescope serves five basic functions:

- It gathers sufficient light
- It sharpens the resolution
- It provides a good definition of the objects being studied
- It magnifies
- It provides a "field of view."

There are two basic types of optical telescopes: refractors, which use a lens, and reflectors, which use a mirror.



The larger a telescope is, the more light it can gather, allowing us to see even deeper into space. With large telescopes we can view amazing sights such as remote star clusters with distinction through their core, and distant suns with evidence of both their birthplace and deathbed in ghostly swaths of gas and dust, the colors of these telling of their chemical composition. We can see very far-away "island universes" called galaxies which come in a variety of shapes and sizes within gigantic clusters themselves, each containing hundreds of billions of stars, gas, and dust. That we can build such an instrument which can take us there without even leaving the ground is a joy unspeakable.

Constructing a Telescope

Even if your library's budget is tight, patrons can still learn the science and history of telescopes. One of the most popular hands-on activities we complete at the Look Up to the Stars: Camp Universe is constructing a telescope. At the camp, we make our telescopes [from a kit](#).

During our camps, students build a small refractor telescope called the Galileoscope. Created as a project for the International Year of Astronomy in 2009, science educators, optical engineers, and astronomers came together to make this high-quality educational telescope kit. The Galileoscope is suitable for both optics' education and celestial observation.

Components:

- The heart of the Galileoscope is a refractor which uses a glass crown and flint objective lens. The lens has been ground and polished to become a high-performance tool of an astronomer. This heart provides the primary light-collecting objective, allowing for the optics of the telescope.
- The rest of the telescope includes the tube and mounting which support and point the "heart" somewhere in the night sky.

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Building a telescope can be one of the most engaging activities for aspiring astronomers.

Being a Discoverer

Astronomy is truly an incredible experience for the young and old alike. Astronomy puts us into the role of a discoverer, seeking out places never seen before, and enables us to venture into realms we can never go, all from our own backyard. Making astronomy accessible to patrons is just one more way librarians can achieve their ongoing mission to bring information and literacy to their communities.

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