The Spectrum

The News Letter of the Buffalo Astronomical Association

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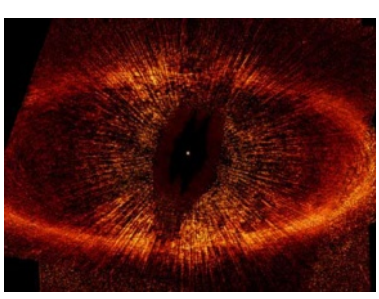

Editors Desk

Mike Benz

As you may know this is my last edition as editor of the Spectrum. I would like to take this opportunity to thank everyone who has submitted articles in support of the Spectrum over the last 2 years. Without

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From the President: BAA Winter meetings

Alan Friedman

Happy New Year! I hope your holidays were happy and peaceful.

I've come to enjoy the winter break from observing. When the clouds close the sky, time opens up for completing unfinished projects and thinking up new ones. Maybe I will get my website up to date with new pictures. I might even get some time to work on those lunar images I captured in the fall of 2008 and 2009. I plan to schlep down to the Winter Star Party in Florida at the end of February and to attend NEAF in April. The year is young, the possibilities endless, and I'm not behind on anything yet. I love January!

Our first meeting of 2011 (Friday, January 14th) will be held again this year at Williamsville North Planetarium. Mark Percy, planetarium director and BAA member, will have a program planned especially for us. You won't want to miss this special show.

On February 11th we will be back at our regular meeting space at Buffalo State College. I will give a talk titled Windows to the Universe – an astronomy travelogue on two recent adventures – journeys to Astro-Physics and Mount Wilson Observatory..

So clean your eyepieces, read some good books, get a little extra sleep… and catch up with your astronomy friends at our winter BAA meetings. Spring and clear skies will be here before you know it.

DARWIN CHRISTY

Rowland A. Rupp

Darwin Christy died on October 15th, after being ill since spring. Until then, he commented, he had always enjoyed good health, could do anything he wanted to do, go anywhere he pleased, and rejoiced in turning 90. Darwin joined the BAA in the early 1960s, served a President from 1972 to 1976, was elected to the College of Fellows in 1985, and edited The Spectrum from 1979 to 1995, a record sixteen years for which he received a commemorative plaque for his service.

Darwin's presidency saw the establishment of Beaver Meadow Observatory. The project was started in 1973 and completed in 1976. Wisely, he delegated club members to negotiate with the Audubon Society, to raise funds, to design the facility, to build it and, finally, to align the mount for the 12.5 inch telescope. Darwin's contribution was to coordinate all these activities, and to keep the membership informed of progress at our monthly meetings and through The Spectrum. He made many other contributions to the BAA; he was an active supporter when the club hosted the Northeast Regional Conference of the Astronomical League in 1967, was a member of the Study Section and, when hosting star parties, served up his renowned chowder.

Perhaps next to overseeing the building of the observatory, his greatest contribution was in editing and supplying material for The Spectrum. As editor, he handled the editing, typing, publishing and distribution. He also frequently contributed articles; some were feature technical articles, others were brief notes. He kept track of year-long seeing conditions at his backyard Honey House Observatory that he built to house his home-constructed 12.5 inch reflector, one of many telescopes he made. Some nights he could see fourth magnitude or better, other nights only first or second magnitude, many nights - nothing at all. His on-going notes seen in each Spectrum spanned decades and included meteor showers, astronomers of the past, and constellations of the ancients.

Darwin had technical talent as well. For years he collected tiny grains of micro meteoric dust on glass slides, which he then viewed with a microscope to separate the space-borne material that drifted down

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your donation of time to write such interesting and entertaining articles the Spectrum would not exist. The Spectrum is not only a newsletter but is YOU the members as it would not exist without the contributions of YOU the members.

After a nation wide search and combing through many resumes' a successor has been found. I would like to take this opportunity to welcome Cheri Harper as the new editor of the Spectrum. Cheri is a new member of the BAA and since joining earlier this year, has volunteered at many public events. She brings a fresh and enthusiastic perspective to the job of editor.

Please welcome her and support her in her new role as the Spectrum Editor!

Astronomy's Little-Known Facts and Misconceptions

Randy Boswell

There is an ancient maxim, which says that if something is repeated long enough it will assume an aura of truth. Take the movie Casablanca, for example. In one of the most memorable scenes of the movie, Humphrey Bogart is typically quoted as saying, "Play it again, Sam." In actuality he said, "Play it, Sam." The world of non-fiction has experienced misconceptions as well. It has been widely said, for example, that Christopher Columbus was the first to discover America. The reality is that the Vikings discovered the new continent before Columbus. The field of astronomy is no different. For example, did astronomer Edwin Hubble discover the expanding universe? Is it a modern paradigm that the universe started as a very small entity and outwardly expanded? And finally, was Galileo the father of the telescope and Isaac Newton the inventor of the reflecting telescope? The answers may be interesting and surprising.

A widely held view is that the astronomer Edwin Hubble discovered the expanding universe. However, Hubble was not the first to observe that expansion of the universe. The first astronomer to observe red shifts from distant objects – the telltale signs of an expanding universe – was Vesto Melvin Slipher (1875-1969). In 1901 Slipher was hired by the then famous astronomer Percival Lowell to operate a custom-built spectrograph that Lowell had installed at his private observatory in Flagstaff, Arizona; today known as the Lowell Observatory. One of Slipher's tasks was to photograph and study the spectra of larges patches of dusk and gas, which were then known as nebulae and considered to be within the Milky Way galaxy. In 1909 Lowell instructed Slipher to concentrate on the spectrum of a white nebula. By "white nebula" Lowell was referring to what we today call a spiral galaxy. At the time, however, many astronomers assumed that these were nearby planetary systems under construction. (Bartusiak, 2009, The cosmologist left behind, p. 31). Specifically, Lowell wanted Slipher to obtain the spectrum of its edges. Lowell was interested in knowing if its spectrum revealed a chemical composition that matched that of the Jovian planets in our outer solar system. A connection would mean the spirals could indeed be baby solar systems under way. (Bartusiak, 2009, The day we found the universe, p. 77). In 1912 Slipher turned the 24-inch Alvan Clark refractor (i.e., the same telescope that Lowell saw the illusionary canals on Mars) on the Andromeda Nebula and obtained surprising results. Its spectrum did not match that of known gases. Instead, it correlated to the spectrum emitted by starlight. Moreover, Slipher discovered that its spectrum was blue shifted, indicating that it was moving towards the earth. He subsequently calculated that the Andromeda Nebula was approaching us at velocity of approximately half a million miles per hour. Upon learning of Slipher's findings Lowell instructed him to study more spiral nebulae. The next spiral nebula that Slipher studied was M81, which is today known as the Sombrero Galaxy. However, unlike the Andromeda Nebula, Slipher found that its spectrum was red shifted, meaning that it was receding away from us. Slipher calculated its speed of recession to be approximately 1,000 kilometers per second. By 1914 Slipher had calculated the velocities of 14 other spiral nebulae. The data indicated a pattern: although a few nebulae such as Andromeda were approaching us, the majority of them were receding away from us. Furthermore, these nebulae were moving at remarkable speeds of up to 2.5

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million miles per hour (1,1000 kilometers per second). (Liu, 2008, p.43). He concluded that these objects were not nebulae at all, but entire systems of millions or billions of stars, so distant that they had to be galaxies. (p. 43). [Slipher] detected the very first hint – the earliest glimmer of data – that the universe is expanding. (Bartusiak, 2009, The cosmologist left behind, p. 31). But it took more than a decade for astronomers to fully recognize what he had done. (p. 31). Slipher remained at the Lowell Observatory for the remainder of his career, serving as its director from 1916 until his retirement in 1954.

Although Edwin Hubble is synonymous in the minds of many with an expanding universe, it was Vesto Slipher who provided the observational basis from which Hubble was to later expand upon in his study of the universe. Hubble (1889-1953) in fact used some of Slipher's data to aid in his determination of the velocity-distance relationships of galaxies, which he later acknowledged in a lecture he gave many years later in 1953. Hubble stated that his findings: "emerged from a combination of radial velocities measured by Slipher at Flagstaff with distances derived at Mount Wilson."(p. 35).

In 1924, using the 100-inch Hooker reflecting telescope atop the Mount Wilson Observatory in California, Hubble isolated Cepheid variable stars in the Andromeda galaxy and using them as standard candles determined its distance from us. Hubble deduced that it was approximately a million light-years away. It turned out that Hubble's measurement was too small. During the Second World War when Los Angeles was blacked out, another Mount Wilson astronomer, Walter Baade was able to determine that there were two types of Cepheids and using the brighter ones between the two types (the type not unlike the ones Henrietta Leavitt discovered in 1912) arrived at the more modern figure of two million light years. Hubble subsequently calculated the distances to other galaxies. By 1929 Hubble had determined the distance to twenty-four galaxies (including the Small and Large Megellanic Clouds), the most remote then judged to reside some 6 million light-years

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through the atmosphere from everyday soot and dust. He rigged a photographic system to take close up enlargements of these sub-millimeter particles, which he could identify by their glassy texture. His expertise on micro meteoric dust became known in Japan, and he and his Japanese colleague corresponded for years. Darwin received the College of Fellows Award in 1987 for his "Micrometeorite Studies."

Working at Niagara Mohawk as a test specialist, Darwin had access to light sensing and electrical recording equipment that he used to monitor light intensity during lunar and solar eclipses. These changes in light were recorded on a chart recorder, and Darwin reported these results in The Spectrum.

Astronomy was just one facet of this versatile man. Having served in the Army Air Corps during World War II, he was active in veterans' organizations and served as chaplain of Tonawanda's American Legion post. He was also a volunteer fireman and a Mason. He loved giving lectures on a variety a subjects to these organizations and to various other groups. He annually attended reunions of his WWII White Knights P-38 squadron members, though lately he lamented their diminished numbers. He had a hobby of photographing the memorials at Gettysburg, claiming he recorded all of them. The loss of Darwin's presence at BAA functions will be sorely missed by his many friends and colleagues.

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away. (Bartusiak, 2009, The day we found the universe, p. 229). He then matched the distances of the galaxies to that of their velocities. What Hubble discovered was a linear relationship between a galaxy's distance and it recessional velocity. That is, with the exception of a few galaxies that are approaching us, the farther away a galaxy is, the greater is its recessional velocity. This became known as Hubble's Law. The expansion rate is known as the Hubble Constant and is expressed as a ratio of velocity to distance. Edwin Hubble's original estimate was approximately 500 kilometers per second per megaparsec. Later, Hubble himself and other astronomers further refined its value. Currently the best measured value of the Hubble Constant is about 73 kilometers per second per megaparsec. (Liu, 2008, pps. 41-42).

What Hubble did was quantify the expansion of the universe, thereby empirically demonstrating its reality. Curiously, Hubble never seemed to fully accept that the linear increase in [red shift] with distance was evidence for the expansion of the universe. (Silk, 1994, p. 52). Nevertheless, Hubble's findings forever changed the way mankind viewed the universe. Again, it was through the pioneering efforts of Vesto Slipher that paved the way for Hubble's achievement. The idea of an expanding universe inevitably led to the view that the universe had its origin at a point in time commonly referred to as the Big Bang.

One such early proponent of this idea was the Belgian astronomer and Jesuit priest, Georges-Henri Lemaitre (1894-1966). In the late 1920's Lemaitre studied the original equations of Einstein's general theory of relativity and echoing a like finding by Dutch astronomer Willem de Sitter (1872-1934) in 1917, concluded that it led to an expansion of the universe. He further deduced that if the universe were expanding that, conversely, it would become progressively smaller as one turned back the cosmic clock. And that meant that at some point, very long ago, the universe would have been at its smallest possible size. (Filkin, 1997, p. 84). Lemaitre postulated that the universe emerged from a singular state of extreme density, which he dubbed a "primeval atom." On account of this, he has been called the father of the Big Bang.

Lemaitre's theory ironically received its popular name from a radio program in 1950 in which Fred Hoyle, a physicist and opponent of Lemaitre's idea derisively referred to it as "the Big Bang." The name remained. Hoyle, along with Herman Bondi and Thomas Gold developed an alternative theory in 1949 known as the Steady State Theory. It postulated that the universe was in a "steady state" with no beginning or end, with matter continuously being created out of a vacuum.

Then, in 1964, strong evidence for the Big Bang came with the discovery of what is known as cosmic microwave background radiation. Two radio astronomers, Arno Penzias and Robert Wilson of Bell Laboratories in New Jersey were testing an ultra sensitive radio telescope designed to receive microwave transmissions from communications satellites. They detected a source of radio noise that was coming from all directions equally. Their measurements revealed the noise to be radiation at a wavelength of 7 centimeters, in the microwave region of the radio spectrum. (Silk, 1994, p. 53).

It was later determined that the temperature of the cosmic microwave background radiation was 2.73 degrees Kelvin. This confirmed the theory of

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physicist George Gamow (1904-1968) who predicted in 1948 that if the Big Bang happened the universe would have been incredibly hot soon after it occurred in order to generate the hydrogen needed to form the first stars. Gamow said that after about 15 billion years (i.e., the then estimated age of the universe) the heat would appear as low-level background radiation and would have cooled to a few degrees above absolute zero.

Penzias and Wilson discovered the afterglow of the Big Bang. They were later awarded the Nobel Prize in 1978 for their accidental discovery.

The afore mentioned brief historical account of the development of Big Bang cosmology has left many with the notion that the idea of the universe originating with Lemaitre's primeval atom and evolving from it is solely a modern paradigm. However, few are aware that a strikingly similar idea was put forth centuries earlier.

A proponent of this was Nahmanides, a Medieval Jewish Rabbinical scholar and philosopher. Nahmanides (1194-1270), also known by his followers as Ramban (based on an acronym for one of his names, Rabbi Moshe Ben Nachmon), was best known for writing a commentary on the Torah, appropriately entitled, Commentary on the Torah. Nahmanides claims to have derived his insights on the origin of the universe on perceived subtleties in the text of the Torah. Nahmanides, [for example], taught that the subtleties found in the Torah go even beyond those of a poem, reaching to the very shapes of the letters. (Schroeder, 1990, p. 21).

Nahmanides's account of the first seconds of the universe reads like this: At the briefest instant following creation all the matter of the universe was concentrated in a very small place, no larger than a grain of mustard. The matter at this time was so thin, so intangible, that it did not have real substance. It did have, however, a potential to gain substance and form and to become tangible matter. From the initial concentration of this intangible substance in its minute location, the substance expanded, expanding the universe as it did so. As the expansion progressed, a change in the substance occurred. This initially thin noncorporeal substance took on the tangible aspects of matter as we know it. From this initial act of creation, from the ethereally thin pseudosubstance, everything that has existed, or will ever exist, was, is, and will be formed. (p. 65 qtd. in Nahmanides, Commentary on the Torah, Genesis 1:1).

This is remarkably similar to today's Big Bang cosmology and one can hear the echo of Nahmanides's words in the modern day description of the origin of the universe. According to the Standard Model of the formation of the universe, the universe began in an infinitely small space with an infinite density known to physicists as a singularity. The conditions at this point are unknown to physicists on account of the fact that conventional mathematics cannot treat such singularities. However, what is known is the conditions from 10-43 seconds after the genesis instant. The universe was then the size of a speck of dust. (p. 65). (Nahmanides's reference to a grain of mustard.). Much of the present mass was then in the form of energy, or radiation, whose equivalent to mass is known through Einstein's famous equation: E=mc2. (Hartmann, 1987, p. 141). (Nahmanides's noncorporeal or pseudosubstance). The temperature at this point was 1032 degrees Kelvin. Then, 10-35 to 10-32 seconds after its initial appearance the universe expanded by a factor of 1050 its initial size. At the end of

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this brief inflationary epoch the universe is said to have reached the size of a grapefruit. After this, the universe continued to expand to its' present size but at a much slower rate. As the universe continued to expand the pressures and temperatures decreased allow for the formation of matter to occur. After approximately 100,000 years the universe cooled to a few thousand degrees Kelvin and atoms began to form. As the universe continued to expand for millions of years tangible matter was formed. The material universe as we understand it came into being. (Schroeder, 1990, p. 67). (Nahmanides's reference to the expansion effecting a change in substance from noncorporeal to tangible aspects of matter).

It goes without saying that our knowledge of the nature and structure of the universe would not have possible without the invention of the telescope. But who really invented the telescope? Most people erroneously attribute the invention of the telescope to Galileo Galilei. (Andersen, 2006, p. 26). However, the earliest known reference to a crude telescope is in connection with Leonard Digges (1510-1571), an English mathematician who experimented with spectacle lenses. His son Thomas Diggins wrote in 1571 that his father: … was able, and sundrie times hath, by proportional glasses duely situate in convenient angles, not onely discovered things fare off, read letters, numbered peeces of money with the very coyne and superscription thereof, cast by some of his friends of purpose upon Downes in the open fields, but also seven myles off declared what hath been done at that instant in private places. (p.25).

The fact that nothing further came of this in the immediately ensuing years remains a mystery. The world would have to wait another 37 years before such a device re-emerged.

Hans Lippershey (1570-1619), a spectacle maker from Middlebury Holland is credited with developing what we would call today a refractor telescope. It is said that he came upon his invention quite by accident. The story is that in Lippershey's absence, his apprentice experimented with his boss's spectacle lenses by looking through various ones. Eventually, he took two lenses and held them both before his eyes, one nearby and one far off, and found, to his astonishment, that a distant weathervane appeared to be much larger and closer. (Asimov, 1975, p. 16). The apprentice demonstrated this to his boos, who devised a metal tube to house the two lenses at their proper positions.

As soon as Lippershey's invention became widely known others laid claim to the new invention. One of these was Zacharias Janssen (1580-1638), a neighbor of Lippershey and a fellow spectacle maker. He claimed to have constructed a telescope in 1604 and it is possible he may have; Lippershey may have borrowed the idea and made up the story of his apprentice to cover the theft. (p. 16).

Whether or not Lippershey was the first to invent such an instrument, what is known is that he greatly promoted its importance and in particular espoused its value as a military instrument by enabling one to view enemy ships approaching at a far-off distance.

The news of the new invention came to the attention of Galileo Galilei (1564-1642), a mathematics professor at the University of Padua in Italy. Word soon reached him 1609 that a Dutchman had arrived in Venice with the intent to sell this instrument to the Doge (the city-state ruler). Sensing a financial opportunity,

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Galileo sought second-hand reports on the instrument in an effort to build one of his own. In the meantime, a good friend of the Doge delayed evaluation of the Dutch [instrument] to buy Galileo some time. (Andersen, 2006, p. 27). Galileo soon began the work of devising a telescope of his own. In perhaps the single most impressive feat of reverse engineering in history, he took just one day to work out the design and improve on it to produce a device far superior to anything in existence at the time. (p. 27). A significant improvement that Galileo made was to increase the magnifying power up to 33 times as compared to a magnification of 3 to 5 times in previous telescopes.

The next big step in the development of the telescope came with the invention of the reflecting telescope. Regarding this, English physicist and mathematician, Sir Isaac Newton (1642-1727) is credited with the idea of using a curved mirror in telescopic design and producing the first reflecting telescope in 1668.

However, knowledge of the optical properties of curved mirrors pre-dates Newton and goes back to ancient times. The ancients, for example, knew that a curved or concave mirror could focus light, as is the case with a lens. Moreover, it was later learned that, unlike lenses, mirrors reflected all the colors of light equally and were therefore free of chromatic aberration. Newton was aware of this and sought to construct a telescope using a primary curved mirror to focus the image, thus eliminating the problem of chromatic aberration that was common to refracting telescopes at the time. [However], he was not really first in the field. (Asimov, 1975, p. 61). Others were putting forth like ideas. Among these was the French mathematician and monk, Marin Mersenne (158-1648). In 1636 he conceived the idea of using two paraboloidal mirrors instead of lenses. However, Mersenne never succeeded in constructing his telescope due to being persuaded by the French mathematician Renee' Descartes that it would never work. This endeavor continued to be pursued by others. Among the most notable of these was the Scottish mathematician, James Gregory (1638-1675). In 1663, Gregory designed and tried to build the first reflecting telescope. Gregory's design called for a concave primary mirror (slightly hyperboloid) and a concave ellipsoidal secondary mirror. According to the design, light entered the telescope tube from one end and struck the primary mirror, which reflected it back to the secondary mirror, which was situated in the center of the tube at the front. The secondary mirror then reflected the light back to the primary mirror where the light converged into a hole in the center of the primary mirror. The light then entered through a magnifying eyepiece to produce the image.

Gregory's objective was to have a telescope that was free of spherical aberration as well as chromatic aberration. His solution was to make use of a non-spherical mirror (i.e., slightly curved) instead of spherical mirror, which produced spherical aberrations thereby resulting in a less-than perfectly sharp image. However, Gregory's telescope proved unfeasible. The trouble was that there was no optician capable of grinding such surfaces accurately, so that Gregory could not get mirrors that did him any good at all and never managed to build a working reflector. (p. 62). Later advances in telescope making ultimately demonstrated the success of Gregory's design. Named after him, the Gregorian design is used in a number of large professional telescopes. Among these are

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the Vatican Advanced Technology Telescope, the Magellan telescopes, the Large Binocular Telescope, and the planned 24.5 meter Giant Magellan Telescope.

Five years after Gregory's design for a reflecting telescope, Sir Isaac Newton produced the first successful prototype. Newton, like Galileo before him took an existing idea and improved on it. Newton succeeded where Gregory failed by using a spherical primary mirror, thereby eliminating chromatic aberration, while at the same time foregoing the more difficult task of trying to solve the problem of spherical aberration; a practical compromise. Only later was the use of a non-spherical mirror incorporated into its design, thus eliminating spherical aberration.

Newton's telescope worked on the same principle as Gregory's design. The difference being that instead of the light being reflected back through a hole in the primary mirror, a flat secondary mirror situated at a 45 degree angle at the front center of the telescope tube reflected the light through a hole in the side of the tube where it passed through a magnifying lens. Known as the Newtonian Telescope or Reflector this design has remained unchanged and is the basis for much of the amateur telescopes produced today. End.

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ANNUAL COLLEGE OF FELLOWS MEETING

Rowland A. Rupp

The annual College of Fellows meeting will be held at 7:30 PM, Thursday, January 27th at my home at 132 Burroughs Drive, Amherst. Please give me a telephone call to let me know if you can or cannot come. My telephone number is 839-1842.

BAA ANNALS

Rowland A. Rupp

5 YEARS AGO - Our meeting for January 2006 was at the Williamsville North High School planetarium where Mark Percy put on a show especially for BAA members. Mark and his planetarium have become a January tradition. Mike O'Connor told us at the February meeting how he analyzed images taken by Tim Puckett to discover a supernova. There was an article from the BAA archives on Caroline Herschel by Irene Rupp. That was about it for this four page Spectrum.

10 YEARS AGO - Jack Mack hosted our January 2001 program in which several

members presented "segments of their favorite astronomical videos." For February, "How's the Weather Up There" was a joint presentation by Bob Hughes and Carl Klingenschmitt - a commentary on the causes and effects of geomagnetic storms. President Dan Marcus promoted the 2001 BAA calendar designed by Alan Friedman. It featured excellent astrophotos by many members. Dan also reported on his traveling around the mid-west countryside looking for a clear spot where he, Tom Bakowski, and Frank Chalupka could observe the occultation of Mu Geminorum. The museum's Kellogg observatory was scheduled to close its Friday night public observation program due to monetary and safety issues. Bob Titran announced that Astronomy Day 2001 would be held at BMO on May 5th.

Spectrum editor Tim McIntyre highlighted some of the accomplishments of the BAA in the past year. These included the observation of a Gamma Ray Burster, our outreach program to schools, using grant money to enhance the observatory, and the $4000 collected from our members in support of the Buffalo Audubon Society's program to expand their nature center. We had 148 members.

15 YEARS AGO - At our January 1996 meeting Gene Witkowski explained how he used inexpensive video cameras to record outstanding pictures of the moon and planets. "Stump the Roundtable" was the title of the February feature in which several BAA members answered questions from the audience. Darwin Christy's "Astronomer from the Past" was August Ferdinand Moebius, a theoretical mathematician of the first half of the nineteenth century. Lots of reviews were featured in this Spectrum. Rowland Rupp reviewed a book sent specifically to the BAA library by its author, John A. Piret. It was entitled How the Universe Was Born, a fair warning for the astonishing speculations that followed. Bill Smith reviewed Gerry Descoteaux's The Lawnchair Astronomer and didn't like it much better than Rowland liked Piret's book. Bill summarized his opinion with "NOT RECOMMENDED." Finally, Bruce Newman reviewed the star charts in SkyMap Version 2.2 (GSC) and heartily approved of it. Individual membership dues in 1996 were $15.00.

25 YEARS AGO - "Telescope Making" was the topic for the January 1986 meeting. Our expert speakers were Bob Mayer, Ed Lindberg, Miro Catipovic, Matt Kanter and Carl Milazzo. Dr. Zoran Pazameta from UB's astronomy department spoke in February on the skies he observed as he was growing up in New Zealand. There was a list of the "navigational stars" - 57 of them - the dimmest was Theta Eridani at 2.92 magnitude. Carl Milazzo reported on telescopes being built by BAA members Larry Carlino, Mike Idem and Miro Catipovic. Darwin Christy and Michael Idem wrote observation reports. Both commented on Halley's Comet, a dominating topic throughout its ongoing apparition. Fred Price reviewed the book Comet! The Story Behind Halley's Comet by Greg Walz-Chojnacki. Fred generally approved, but noted much of the material was available in magazines and text books.

35 YEARS AGO - January 1976, Ernst Both, the museum's Curator of Astronomy, spoke on the "Grand Tour of the Universe." "The Infinite Worlds of Giordano Bruno" was Dr. Antoinette Paterson's February presentation. Dr. Paterson was Professor of Philosophy at Buffalo State. Tom Dessert summarized the history of how BMO came into existence. (Perhaps we can re-print this article in a future Spectrum.) Ernst concluded his article, started in the last Spectrum, on "The Largest Telescope on This Side of the Atlantic."

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Location/Time of Meetings:
BAA meetings are held on the 2nd Friday of the month from September to June starting at 7:30 P.M. Due to construction, our normal meeting room in the Science Building at Buffalo State College will not be available during the fall semester. Beginning September 2009, our meetings will be held in Classroom Building C122 located just to the north of the Science Building. Follow directions (#35) on the Buffalo State College map.