A FIFTY YEAR ANNIVERSARY OF A TWO THOUSAND YEAR DREAM

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The planetarium profession started just 50 years ago. At that time, progress in optics, instrumentation, and electricity made possible the realization of a two thousand year old idea - a perfect representation of the starry sky inside a room. With it came the possibility to have a celestial time machine, with time marked by the motions of the planets.

Twenty centuries ago, maps of the sky were placed on the outside of globes to illustrate the heavens for the purposes of art and of learning. Some actually moved, reproducing the diurnal motion. Archimedes is credited with the first device demonstrating planetary motions about 250 B.C. After he was killed by invading Romans, the device was taken to Rome as booty where it was seen and described by Cicero. Its fate remains a mystery. Later, Ptolemy's globe is alleged to have even demonstrated the precession of the equinoxes.

The next improvement came with the enlargement of the globes. The most famous, the Gottorp globe constructed in the middle 17th century (it took 20 years!), was about 4 meters in diameter, weighed over 3 tons, and could seat several persons inside on a circular bench. The stars were holes in the globe.

Other globes like the Gorroro sphere were built, one of the last being the Atwood globe in 1913 for the Museum of the Chicago Academy of Sciences. With a diameter of almost 5 meters the Atwood globe shows 692 stars, and a moveable light bulb represents the Sun. Apertures along the ecliptic, which can be uncovered as necessary, represent the planets.

With the coming of the Copernican idea (whose 500th birthday we also celebrated this year) and with advances in instrument-making, various models of the planetary system were constructed as teaching devices. These are called "orreries" in English, but they are also known as planetaria, which serves to confuse things. The orreries reached their culmination in the large ceiling orreries at Munich (since destroyed), Chapel Hill, and New York. Meanwhile, elaborate astronomical clocks were developed showing various sky events. Thus the stage was set for the entrance of the next advance.

The First Projection Planetarium

Generally considered as the first projection device for showing planetary motions is the Orbitoscope, invented about 1912 by Prof. E. Hindermann in Basel. This instrument is driven by springworks and has two planets revolving about a central Sun. A small light bulb on one of the planets projects shadows of the other two objects in the directions they would be seen from that planet, reproducing accurately the retrograde loops and speed changes. This ingenious device is useful for instruction, but of course had many shortcomings.
The Deutsches Museum and Carl Zeiss

The idea of realistically reproducing the sky in detail is due to astronomer (and then privy counselor) Max Wolf. He was involved with the Deutsches Museum, a then-new institution devoted to science and technology.

The museum was the brainchild of Oskar von Miller, an engineer interested in all aspects of science. He founded it in 1903 with the help of such other well-known scientists as von Siemens and Roentgen. 1906 saw the preliminary opening in temporary quarters. The museum eventually was given the beautiful island in the Isar River as its new home in Munich, but the opening planned for 1916 was postponed due to the war. The fully constructed museum finally opened in 1925.

In 1913, Wolf had suggested to von Miller the idea of a device for his museum which would reproduce not only the stars but also the planetary motions. von Miller approached the well-known optical firm of Carl Zeiss in Jena, and they agreed to look into the problem.

Carl Zeiss Company had begun in 1846, where that skilled instrument maker produced microscopes in his home workshop. Later collaboration with Ernst Abbé resulted in the first optical instruments produced from theory and plans, rather than from trial and error. Later still, Otto Schott, a glassmaker, introduced a process for producing good quality optical glass reliably, and the company established its reputation as a maker of high-quality optical goods.

The Idea

It was from this background that the planetarium sprang. About March 1919, Walther Bauersfeld, chief design engineer and later director of Carl Zeiss, hit upon the idea of projection of the celestial objects in a dark room. The original plan had been for some sort of globe similar to that of Gottorp. The new idea simplified things immensely. The mechanism could be on a small scale and easily controllable.

Five years of calculations and trials were needed to bring this idea to fruition. Five years, in which Bauersfeld and a large staff of scientists, engineers, and draftsmen considered the astronomical principles involved and the mechanical devices which would realize them. They rediscovered the work of Christian Huygens, who had used the mathematics
of continued fractions to construct his famous orrery in 1682. They constructed star plates of film with images of 4500 stars. They found ways of interconnecting the daily and annual motion drives so the planets would stay in proper relative positions. In short they invented the modern projection planetarium.

In August 1923, a 16 meter dome was set up on the roof of the factory in Jena, and the first Model I projector was installed. The “Wonder of Jena” had its first unofficial showings there. Then the instrument was taken down, shipped to the Deutsches Museum, and installed there in a 10 meter dome.

On October 21, 1923, Prof. Bauersfeld demonstrated the projector to a congress at the museum, the first official public showing. The professional and public reaction was enthusiastic.

After this debut, the instrument was again returned to Jena for finishing touches, finally being permanently installed in Munich in May 1925. It operated there until the beginning of World War II, when it was taken down and put in safe storage. Thus it survived the bombing which almost totally destroyed the museum in 1944-45. After the Deutsches Museum was rebuilt, the original Model I was re-installed on May 7, 1951. It has since been replaced with a Model IV, and the planet cage is in storage at the museum. The star projector has been loaned to the Max Planck Institute, being used for research in bird navigation by the stars.

Spreading The Word

The planetarium so impressed many scientific and civic leaders in Germany that in the few years following the first Model I, several other cities ordered and received projectors. Dusseldorf installed a Model I, then replaced it with a Model II which Zeiss had developed in the meantime. (This planetarium had a 30 meter dome, one of the largest ever constructed, and totally destroyed in the war.) The Model II was the large dumbbell-shaped projector which everyone has since identified with Zeiss. 1927 saw the first planetarium outside Germany, a temporary installation in Vienna. The Rome planetarium opened in 1928 (now alas, a cinema!), and the Moscow planetarium in 1929. Except for Munich and Jena, all of these early installations had linen domes.

1930 witnessed five new planetaria, including ones in Stockholm, Milan, Hamburg, a new one for Vienna, and the first outside of Europe. In 1928, Max Adler, a Chicago philanthropist, heard of the “Wonder of Jena” and took his wife and an architect to Germany to see it. He was so impressed, he donated to his home city the first planetarium in the Americas. On May 12, 1930, the Adler Planetarium greeted its first visitors. Over 22 million have since seen its Sky Shows and exhibits.

Also attracted to the Zeiss planetarium about the same time were Samuel Fels of Philadelphia, Col. G.J. Griffith of Los Angeles, and Charles Hayden of New York. They all saw the machine in operation and were sufficiently impressed to give planetaria to their communities. The Fels
Planetarium became the second in the U.S., opening on Nov. 1, 1933, and 1935 saw the opening of the Griffith Planetarium on May 14 and the Hayden Planetarium on October 2. During these years, other instruments began to show the sky in Sweden, Belgium, and Holland. Except for the latter, all were Model II's.

The Orient got its first glimpses of a planetarium sky in Osaka in 1937 and Tokyo in 1938, the latter soon-to-be totally demolished in the war. 1939 marked the first instrument on an elevator, the Buhl Planetarium in Pittsburgh. During the 1930's, Carl Zeiss also designed and built many small projectors, used mainly for navigation instruction for pilots. (One may be seen in operation today at the Science Museum in London. It was captured at the end of the war.)

The 1930's also saw the first non-Zeiss planetarium, designed and built by the Korkosz brothers in Springfield, Massachusetts, and installed in the museum there. The device projects 9500 stars, but has no planet projectors. Later a similar device was built for the Charles Hayden Planetarium in Boston, endowed by the same person as the New York Planetarium. (The Korkosz projector in Boston has since been replaced by a Zeiss Model VI.)
The War, and After

During World War II, Carl Zeiss produced few planetarium instruments. The only large installation, a Model II, was in Göteborg, Sweden in 1944. It was removed to the Morehead Planetarium in Chapel Hill, N.C. in 1949.

In 1945, Russian troops occupied Jena and took over the Carl Zeiss factory. Prior to the occupation however, Allied troops had evacuated about a hundred top company personnel to the American sector and resettled them in Heidenheim, near Stuttgart. The Jena facilities were dismantled by the Reds, but later the factory was reorganized. Today Carl Zeiss of Jena again produces optical equipment, including several sizes of planetarium projectors. Most of the post-war Jena instruments are inside the Iron Curtain countries. A few are found in some of the major Canadian planetaria.

The refugee personnel reorganized the now West German company and established a new factory in the beautiful small town of Oberkochen. They have since built up once again a vigorous production of high quality optical goods. The numerous advances made in recent years in planetarium technology have culminated in the Zeiss Model VI instrument now found in many major planetaria.

Immediately after the war neither Oberkochen nor Jena were capable of building a planetarium projector. Because of this, the California Academy of Sciences in San Francisco commissioned a comparable, one-of-a-kind projector for the Morrison Planetarium. After four years of design and construction, it was opened on November 6, 1952.

Everyman’s Planetarium

In 1936, Armand Spitz, a Philadelphia newspaperman, took a part-time job as a lecturer at the Fels Planetarium and immediately saw the pedagogic possibilities of the planetarium. He also saw that it was impossible for a small school or museum to have one because of the great cost in money and space. He set out to build a projector which would give a reasonable reproduction of the sky but sell for a couple of orders of magnitude less than that of the large Zeiss. The result was the famous Spitz dodecahedron used in the Models A, A-1, and A-2. His invention has caused his colleagues of today to affectionately name Armand Spitz the “Henry Ford of the planetarium field.” All were saddened by the news of his death on April 14, 1971.

The first Spitz projector was demonstrated to a meeting of astronomers at Harvard College Observatory in the late 1940’s. The small projector was a great success, despite the lack of planetary motions and with a motor drive for diurnal motion only. In 1949, Spitz Laboratories was founded, first in an old factory building and then in an old theater. As the enterprise grew, they later moved to an old snuff factory in Yorklyn, Del. and are now located in a spacious new factory in Chadds Ford, Pa. The company has changed its corporate ownership several times in its brief history and is now Spitz Space Systems, Inc.

The Spitz Model A-1 improved on the Model A by having star images of different brightnesses. The control panel was modified and enlarged. Next came the A-2 and then the idea of a much larger projector with planet motions and
suspended by cables from the dome. The result during the 1950’s was the Model B, of which only three were made, all still operating. The first was the Montevideo (Uruguay) Planetarium, which opened in February 1955, the first in South America. The others are at the Air Force Academy in Colorado Springs and the Longway Planetarium in Flint, Michigan. Spitz Laboratories concurrently produced one intermediate-sized Model C, now the planetarium at the Minneapolis Public Library.

During the 1960’s, Spitz widely sold the Models A-3 and A-3-P with planet motions and spherical star projectors as well as the more advanced and larger Model STP (Space Transit Planetarium). Planetary motions for these instruments differed from the Zeiss concept in that they were derived from electrical analogs instead of gearworks. Still later has come the Spitz A-4 and A4A (now System 512), which may be completely automated. The company has pioneered in one-way planetarium seating and inclusion of azimuth rotation among other innovations. There are now some 700 Spitz projectors of varying sizes throughout the world. The latest and most sophisticated development is the Model STS (Space Transit Simulator), a departure from standard planetarium design both in the projector and the theater. Complete programming is possible with a built-in digital computer, and the system resides in a tilted hyper-hemispherical dome. The first STS was installed in early 1973 at the San Diego Hall of Science.

From Across the Pacific
Toward the late 1950’s, Seizo Goto, a leading Japanese industrialist, used the expertise of his company in the field of telescopes to produce the first Goto planetarium. After trials in Japan, the first Goto in the United States filled the sky with stars in Bridgeport, CT on January 20, 1962. The Goto company was actually the first to produce a small projector which included planetary motions. Many Goto instruments have since been installed all over the world, a large number in the U.S. These planetariums are currently distributed in North America by Mitsubishi, Inc.

Somewhat later, the Minolta Company of Japan, known for high-quality cameras and optics, made some tentative entries into the field in the mid-1960’s. The first major planetarium was at DeAnza College in California. By the late 1960’s, Minolta had decided to officially enter the planetarium business, and they now produce a line of projectors of all sizes. These are distributed in North America by Viewlex, Inc. of Holbrook, N.Y. The latter firm also manufactures their own lines of small, automated planetariums.

Later
Since World War II and particularly since the flight of Sputnik I, the number of planetaria has grown tremendously. With this growth the projection systems have become more sophisticated in operation and accurate in their...
portrayal of the heavens. Many projectors now have provision for automation of the entire program.

Many school systems and colleges now use a planetarium in their astronomy courses. While the small planetaria find their primary use as teaching devices, the planetaria in museums serve the function of informing an interested audience of the wonders and discoveries of astronomy, from the simple identification of constellations to elaborate, sophisticated multi-media shows demonstrating and explaining concepts which were not even around when Bauersfeld first proudly demonstrated his “Wonder of Jena”; e.g., quasars, pulsars, and black holes. (Actually black holes were “invented” about 1913, but no one thought of talking about them in a planetarium!) Modern planetaria have been used for the performance of science fiction plays, musical events, and multi-media shows with light, sound, and live performers.

The planetarium, both as a fine instrument and as an institution, has come a long way since 1923 when astronomer Elis Strömgren wrote:

“Never before was an instrument created which is so instructive as this; never before one so bewitching; and never before did an instrument speak so directly to the beholder. The machine itself is precious and aristocratic...The planetarium is school, theater, and cinema in one — a classroom under the eternal dome of the sky.”

And it is still true today. (End)