Air and Space this Week

Item of the Week

GERARD PETER KUIPER: FATHER OF PLANETARY SCIENCE

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Astronomy has been a science since Antiquity. Much of past attention was on stars and galaxies; the planets were useful in working out the basics of orbital mechanics, but we lacked the technology to study them, and their moons, in any sort of geological detail. That started to chance after WWII, but advances came slowly until we began flying spacecraft by other worlds, then orbited them, then landed and roved some of their surfaces. Before spaceflight, there was really only one astronomer who really focused things "close to home," Gerard Kuiper.

GERARD PETER KUIPER

Gerard Kuiper was born on **December 7**, 1905, in Tuitjenhorn, a small town in North Holland. He was blessed with very keen eyesight, which helped pique his interest in astronomy during his formative years. He went to the Leiden University in 1924, which was a hotbed of astronomy, both students and faculty. His received his undergraduate degree in 1927, and stayed on to earn a dissertation under Ejnar Hertzsprung (famous for the Hertzsprung-Russell Diagram). Jan Oort was also on the Leiden faculty at the time, and Bart Bok and Pieter Oosterhoff were fellow students. What an amazing place Leiden must have been!

Kuiper completed a dissertation on binary stars in 1933, then went to post-Doc under Robert Aitken at Lick Observatory, outside of San Jose, California. His first position was at Harvard College Observatory (1935); he moved on to Yerkes Observatory (University of Chicago) two years later. He would stay with the University of Chicago for much of his career.

WILLIAM JOHNSON MCDONALD

Paris, Texas, was a prosperous rail and supply center in northernmost Texas in the second half of the 1800s. A fire devastated much of the town in March, 1916, but the business and wealth were still there, and the town and its economy quickly recovered.

William Johnson McDonald was born there in 1844. A private in the Confederate Army, he prospered after the Civil War as a lawyer and banker. Somewhere along his way through life he must have developed an interest in astronomy, because his will left almost all his wealth to the University of Texas, for the purpose of erecting and astronomical observatory for use in the UT

astronomy department. There was no such department. UT got the bequest and the money, then they had to be a bit creative.

The fastest, best way to meet the requirements of the bequest was through partnering with an established university astronomy program, while building an observatory. The best potential partner was judged to be the University of Chicago, which had a strong faculty and operated the Yerkes Observatory in southern Wisconsin.

The deal was struck in November, 1932, ninety years ago.

The UT observatory, named of course for W.J. McDonald, was set up on paper, and the partnership allowed for it to be managed via the UC and its faculty. UC professor, Otto Struve, was named as its first director.

A search was made for a suitable, and available, site for the McDonald Observatory. A Mrs. Violet Locke McIvor donated a good site in the Davis Mountains of west Texas in 1933. Her grandfather had originally established a large ranch in the area, and she generously gave up a large hill, subsequently re-named "Mount Locke" in her family's honor. Another generous donation, this one by estate of Edwin H. Fowlkes, a Fort Davis Judge, added an adjacent observing site, re-named "Mount Fowlkes." Dr. Struve and the UC team was looking for the future and wanted the Fowlkes site to accommodate any expansion of the observatory with time. Good thinking; it was.

McDonald Observatory was formally dedicated on May 5, 1939.

BACK TO KUIPER

The University of Chicago Astronomy Department faculty provided administrative leadership at both the Yerkes and McDonald Observatories, on somewhat of rotating basis. Dr. Kuiper served two two-year stints at McDonald, the first starting in September, 1947, and the second starting exactly one decade later.

Kuiper began making a series of important discoveries in the Solar System in 1947. He'd already discovered that Saturn's large moon, Titan, had an appreciable atmosphere, a quite unexpected situation, back in 1944.

Two really good years followed the War. In 1947, Kuiper hypothesized (correctly) that Mars' atmosphere would be predominately carbon dioxide; deduced that Saturn's rings could not solid, but instead were composed of icy particles, not rock; and discovered Uranus' odd fifth moon, Miranda. In 1949, he discovered Neptune's second moon, Nereid, and supplied considerable evidence in support of the condensation theory of planetary formation in the Solar System.

Two years later, Kuiper published his thoughts on a topic for which most of you know him today. Based on his study of cometary orbits, he hypothesized that there had to be a large number of trans-neptunian objects in the outermost Solar System, a grouping now known as the "Kuiper Belt" in his honor. His former professor, Jan Oort, made a similar study, but

considered longer-period comets, and hypothesized an essentially-interstellar mass of icy objects, in what today is known as the "Oort Cloud."

By now Kuiper was a master of ground-based telescopic observation of the planets in the Solar System. Through the use of spectroscopy and thermocouples, he was able to show that the transient polar caps readily observed on Mars were composed of water ice, not frozen CO2.

Kuiper had two more Big Things to accomplish. He left UC in 1960 and moved to the University of Arizona in Tucson, where he founded the Lunar and Planetary Laboratory, which is still to this day one of the major academic forces in planetary science.

The second major accomplishment was built around Kuiper's desire to make near-infrared planetary observation, something difficult to do from a ground-based observatory because Earth's air blocks those wavelengths. He knew how to make IR detectors, but needed an observing site above (most of) the atmosphere. The solution: Mount an IR telescope inside and airplane and fly it into the stratosphere to make extended observations.

NASA acquired a Convair 990 jet aircraft in 1967 and made the necessary conversions to make it a flying IR platform. Appropriately, it was dubbed the *Kuiper Airborne Observatory*, and it made important observations for many years thereafter, before being replaced by the *SOFIA* airborne observatory, a modified B747 with a 106" telescope aboard. Among the important observations made on the *KAO* was the discovery of the ring system of Uranus (see here).

Kuiper stayed very active in the now-burgeoning field of planetary science through the 1960s. He was an important part of the team searching for appropriate landing sites for the Apollo program (which culminated 50 years ago next week with the departure from the Moon by *Apollo 17*). He also did at least some work "in the black," including a secret USAF plan to detonate a nuclear weapon on the Moon in 1958, Project A119. [Bad idea. We didn't do it. Neither did they.]

Kuiper was an indifferent teacher, and tended to treat his graduate students like assistants, not colleagues. But what graduate students they were! Carl Sagan was one, and didja know, he worked with Kuiper on the A119 project! Dale Cruikshank was another, a noted planetary scientist at NASA Ames, specializing in minor bodies of the Solar System. William Hartmann was there, too; he was a founding member of the Planetary Science Institute research organization and a noted astronomy/planetary artist [I made sure that one of his depictions of meteor impact was included in the updated Exploring the Planets gallery at the National Air and Space Museum]. Yet another was Alan Binder, who was the Principal Investigator on the Lunar Prospector mission and was a member of the Viking lander camera team.

Kuiper won a variety of science awards during his career, and an asteroid (1776 Kuiper) and three craters (on Mercury, Mars, and the Moon) were named for him. The Division of Planetary Sciences of the American Astronomical Society awards the Gerard P. Kuiper Prize for career achievement annually; Gene Shoemaker, Fred Whipple, Jim Pollack, James Van Allen, and Carl Sagan were awardees. So was my freshman advisor, Peter Gierasch, and the professor who

gave me the wonderful opportunity to do grunt work on new Viking images of Mars' moons, Joe Veverka, my first small, but significant, taste of planetary research.

Gerard Kuiper passed away on December 23, 1973.

MCDONALD OBSERVATORY TODAY

The relationship between the University of Texas and University of Chicago was for a thirty-year period from the get-go, and in September, 1963, McDonald Observatory moved over to UT management. The first director was Harlan J. Smith, a fine scientist, manager, and gentleman I had the very great pleasure to meet while I was a post-Doc at the Lunar and Planetary Institute (see my Item of the Week tribute to him here).

Smith took aggressive action to expand and upgrade McDonald, and in 1968, a new, very large (107") telescope was dedicated. It now bears his name. McDonald was used to determine the Earth-Moon distance (and its small but important changes) to an extremely high level of precision, by firing a laser through its optical system and bouncing it off the retroreflection mirrors left on the Moon by some of the Apollo missions.

McDonald Observatory has also played an important role in public outreach. On October 1, 1978, the *StarDate* radio program debuted. It provides interesting astronomical vignettes to over 300 participating stations, and is the longest-running, nationally syndicated science radio program in the US! The program has grown to include a strong on-line presence and education support capabilities.

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