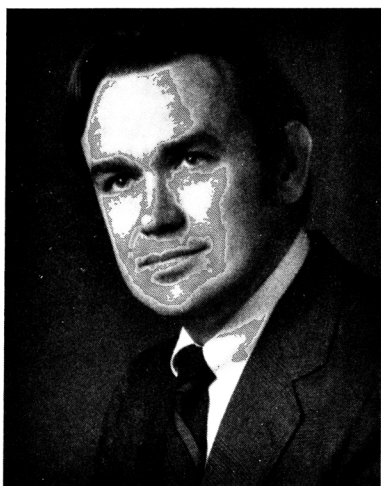


Marcus Gerhardt Langseth

Marcus Gerhardt Langseth, a pioneer in the investigation of the thermal histories of the Earth and Moon, died on 4 January 1997, at age 64, in Palisades, New York.

He worked at the Lamont-Doherty Earth Observatory of Columbia University for most of his career, starting as a summer hired hand in 1953. He earned a BS from Waynesburg College in 1954 and joined Lamont-Doherty full-time in 1955. After two years in the Army (1956-58), he returned to the observatory as a graduate student, earning a PhD from Columbia in geology in 1964. Subsequently, he was a research scientist at Lamont-Doherty and concurrently an adjunct professor in the department of Earth and environmental sciences at Columbia. As of 1993, he was senior scientist at Palisades Geophysical Institute.

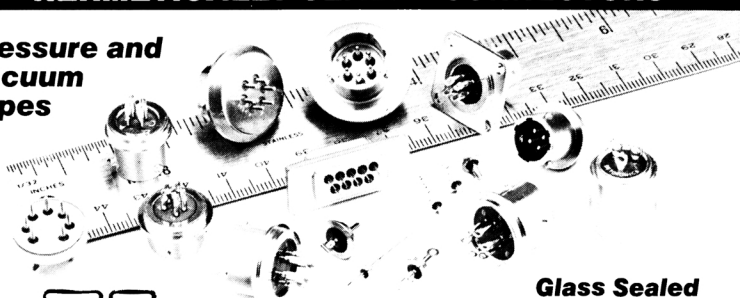
Langseth used the measurement of the thermal gradient in the subsurface of Earth's skin, combined with measurements of the thermal conductivity of the recovered soils, to calculate the flow of heat from the underlying mantle. For Earth, his strategy involved the spatial variability of the heat released both from continents and the ocean floor. In the 1950s and 1960s, he sailed on research ships throughout the world's oceans. He recorded the thermal gradient in the seabed using a long sediment coring tube, to the outside of which he attached a string of sensors whose electrical resistance would change with the temperature of the mud into which they had been inserted. Thanks to the great reliability and ruggedness of the equipment he designed, Langseth was able to



MARCUS GERHARDT LANGSETH

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The pattern of heat escaping through the ocean floor showed the highest heat flow along the crest of the mid-ocean ridge, which is located near the center lines of the Atlantic and Indian Oceans and is offset to the east in the Pacific Ocean. Lower values were registered in the deep basins and on the continental margins. Working with Richard Von Herzen at the Woods Hole Oceanographic Institution in the 1960s, Langseth was able to demonstrate convincingly that the high heat flow coincided with the separation of Earth's lithospheric plates and must have been caused by the active upwelling of the warm interior of the planet. Thus, Earth possessed a convective layer of ductile rock.

Between 1966 and 1975, Langseth directed the Apollo Lunar Heat Flow Experiment to learn if the Moon's interior was still hot and if there was relatively young volcanic activity on the Moon's surface. He developed a drill the astronauts used to insert temperature-measuring sensors into the unconsolidated regolith of dust and rock fragments at a sufficient depth to get away from the obscuring effect of the diurnal heating and cooling of the Moon's surface. In this airless environment, it was critical that the jacket of electronic thermometers be placed in direct contact with the soil to ensure a conducting pathway. The drilling and recording equipment was first sent aboard the ill-fated Apollo 13 mission. Then, on the Apollo 16 landing, an astronaut's misstep ripped apart a critical telemetry cable. However, Langseth was able to show from the subsequent Apollo 17 data that Earth's only satellite had already lost most of its original heat. The results fitted a fission model for the Moon's origin, according to which it carried away already differentiated layers of Earth relatively depleted in radioactive elements.

Langseth's recent projects quantified the flux of fluid out of the seabed as the result of the compaction of the sedimentary layer where the oceanic lithosphere is thrusting under the edge of a continent. He was able to show that this dewatering acts rapidly as the mud is squeezed in thrust sheets, and that the venting is through narrow conduits produced when the seabed ruptures along faults.

Langseth will be remembered for his keen insight into physical processes, for his tireless contributions to workshops and planning committees and for his sweet and gentle character.

WILLIAM B. F. RYAN

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Richard Tousey

Richard Tousey, the leading pioneer in solar research from space, died in Mitchellville, Maryland on 15 April 1997, at the age of 88. He carried out all his research during a 37-year long distinguished career at the Naval Research Laboratory in Washington, DC.

He was born in Somerville, Massachusetts, earned his AB in physics and mathematics at Tufts University in 1928 and his PhD in physics at Harvard University in 1933. Under Theodore Lyman, Tousey worked at Harvard on the extreme ultraviolet reflecting powers of materials.

In 1941 Tousey met Edward O. Hulburt, later the first director of research at the Naval Research Laboratory, when their sailboats were at anchor in Bucks Harbor, Maine. Hulburt invited Tousey to join him at NRL's physical optics division. This sailboat encounter set the course for solar research from space for the rest of the century.

During the war years, Tousey worked on vision through telescopes and binoculars as well as on infrared sensors for surveillance in total darkness.

With the arrival of German V2 rockets in the US, it suddenly became feasible to explore the solar ultraviolet spectrum. Hulburt suggested that Tousey build an ultraviolet spectrograph, mount it on a V2 rocket and photograph the Sun's UV spectrum from above the absorbing Earth atmosphere. The first flight took place on 28 June 1946 at White Sands, New Mexico, but the rocket crashed into the desert, and no piece of the spectrograph was ever found. A second launch on 10 October worked as planned. Many spectra were photographed at different altitudes, showing not only the existence of the Sun's UV spectrum down to 2200 angstroms but also its absorption by the ozone layer as a function of altitude.

Sounding-rocket work continued at NRL. In 1948, using thermoluminescent plates, Tousey established the existence of the chromospheric emission line of hydrogen Lyman-alpha at 1216 Å. A profile of Ly-alpha obtained by Edward Purcell and Tousey in 1960 showed the existence of the extended geocorona. In the years following, Tousey and his coworkers studied the solar UV spectrum at shorter and shorter wavelengths. They detected the allowed transitions of many highly-ionized elements and established that these lines are emitted from the hot solar corona at $1.5\text{--}2 \times 10^6$ kelvin. In 1959, the first image of the Sun in the light of Ly-alpha was obtained by Tousey and colleagues, setting the

stage for imaging the Sun in many UV lines and with high spatial resolution.

Under Tousey's direction, researchers at NRL conducted an extensive study of ultraviolet optical materials and reflecting coatings.

In 1963, together with Martin Koomeen, Tousey built and flew on a sounding rocket the first coronagraph to photograph the Sun's corona from space; this instrument extended coronal observations out to 10 solar radii. The first coronagraph flew in space aboard a satellite in 1971, and was followed by several others. In his last days, Tousey was able to see on the Internet images of the solar corona transmitted by NRL coronagraphs on the Solar and Heliospheric Observatory spacecraft.

The culmination of Tousey's ultraviolet work was Skylab, flown in 1973–74 with two instruments—a large UV spectrograph and a large spectroheliograph—designed by him and his colleagues. The spectroheliograph provided a spatial resolution of 2 arcseconds. Among the numerous results of this big project was the famous HeII 304 Å image of a lifting prominence on 19 December 1973.

Tousey had many hobbies: bird-watching, restoring an old harpsichord, playing the harpsichord and sailing. Recently, he had assembled a large collection of old silver spoons. He excelled in everything that he did.

Tousey was the fastest man I ever met, almost running all the time. No obstacle was too big for him to overcome. With his deeply probing mind, he had a tremendous sense for detail, and he was a perfectionist. At the same time, he cared very much for his people, leaving room for us to develop. We at NRL will miss a great teacher, mentor and friend.

GUENTER BRUECKNER

*Naval Research Laboratory
Washington, DC*

Roger John Tayler

Roger John Tayler, who died in London of myeloma on 23 January 1997, was one of the first astrophysicists to construct realistic models of inhomogeneous stars. In his PhD dissertation, written in 1954, he discussed how stars evolve as a result of the thermonuclear conversion of hydrogen to helium, using calculations he had carried out with a mechanical, hand-operated computing machine. His work paved the way to a new level of sophistication in astrophysical modeling.

Roger was born in Birmingham, England, on 25 October 1929. After graduating in mathematics in 1950