

Exploring the CHEMISTRY of MARS

A National Historic Chemical Landmark



ACS
Chemistry for Life®



An Infrared Light in the Darkness

A mere 50 years ago, we knew almost nothing about the planets of our solar system.

We had essentially no information on the chemical properties of the planets and their atmospheres until 1969, when NASA launched the Mariner 6 & 7 spacecraft, which both flew within a few thousand miles of Mars.

The Spacecraft



Mariner 6 & 7

Mars & Mariner photos: NASA

The Team Leads

The Tool

Kenneth Herr

1937-2015

George Pimentel

1922-1989

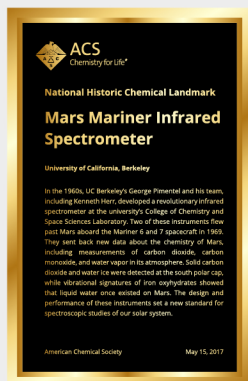
Infrared Spectrometer

Each spacecraft carried an **infrared (IR) spectrometer** designed and built at the College of Chemistry and the Space Sciences Lab at the University of California, Berkeley.

The IR instruments on the Mars Mariner spacecraft successfully scanned the atmospheric and surface chemistry of Mars, transmitting IR spectral data back to Earth.

Mars Mariner Infrared Spectrometer— A National Historic Chemical Landmark

The American Chemical Society (ACS) designated George Pimentel and Kenneth Herr's design of a revolutionary infrared spectrometer as a National Historic Chemical Landmark (NHCL) in a ceremony at the University of California, Berkeley, on May 15, 2017. The Landmarks program (www.acs.org/landmarks) recognizes major achievements in the chemical sciences.



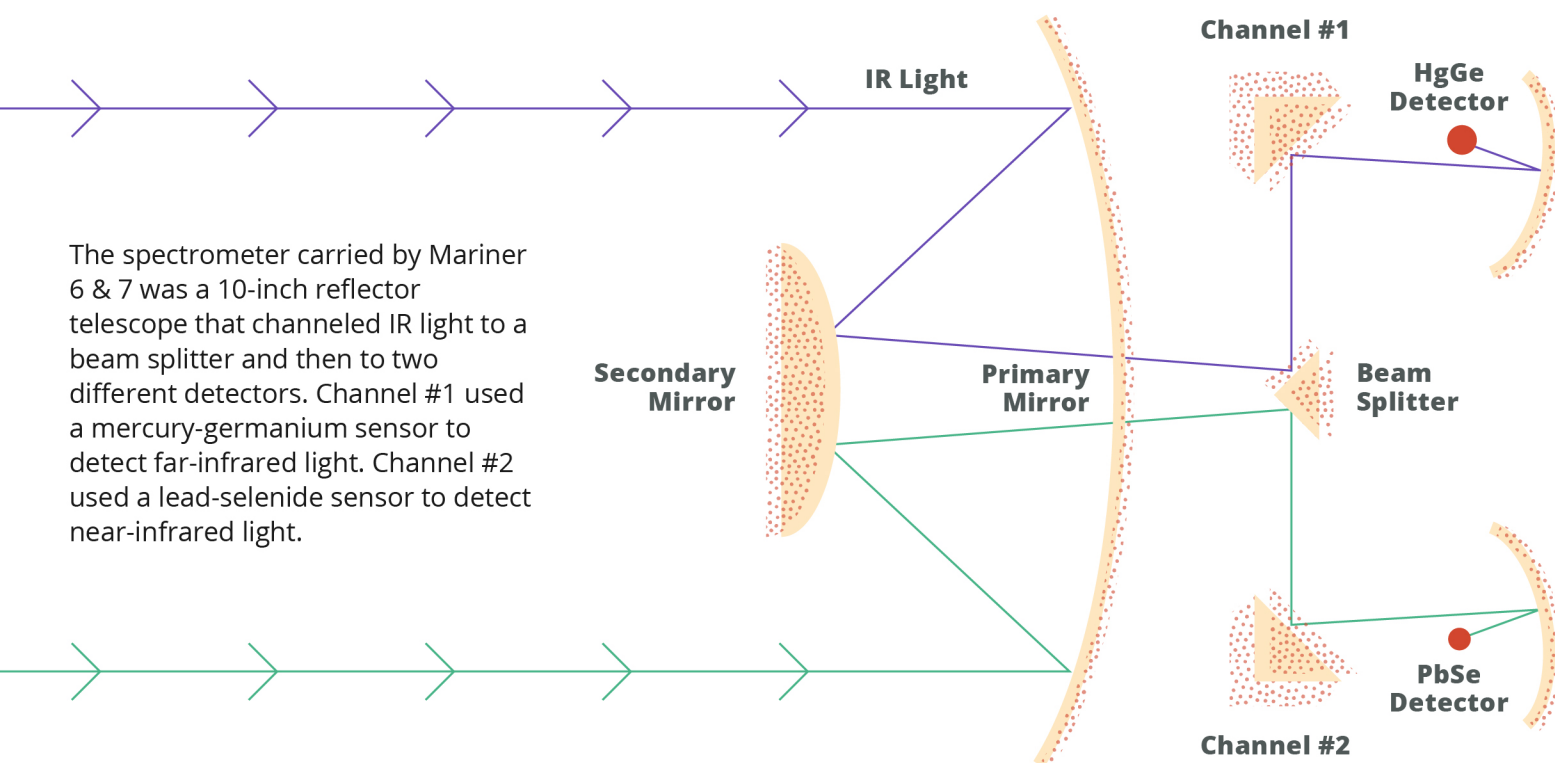
“The infrared spectrometer was a groundbreaking design of unprecedented sensitivity, mechanical stability, and environmental robustness, which enabled it to make the first chemical measurements of the makeup of the Mars surface and atmosphere.”

— Richard A. Mathies, chemistry professor, UC Berkeley, 2016

Spectroscopy— What Is It?

Spectroscopy is the study of the interaction between matter and electromagnetic radiation.

An infrared (IR) spectrometer measures the absorption of infrared radiation by a sample. The resulting IR spectrum is characteristic of the chemicals present in the sample.



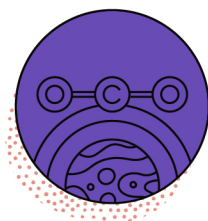
What Did We Learn About Mars?



Determination of the composition of the Martian atmosphere



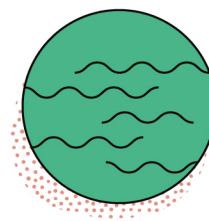
Determination of water vapor concentration in the Martian atmosphere



First evidence for solid CO₂ in the upper atmosphere



Observation of solid water and water hydrates on the Martian surface



Detection of goethite, which forms in aqueous weathering processes, the first evidence that there was once liquid water on the Martian surface