# The heat flow of the Moon, revisited

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The Apollo Lunar Surface Experiment Packages (ALSEP) at the Apollo 15 and 17 sites contained heat flow experiments that monitored surface and subsurface temperatures for a period of almost 4 years. One important result reported from analyses of these data is that the heat flow at the Apollo 15 site is apparently significantly greater than at the Apollo 17 site (21 vs. 16 mW/ m2). This is of particular importance as these two measurements were made in two of the most distinctive geologic provinces of the Moon—the Procellarum KREEP Terrane and the Feldspathic Highlands Terrane. The goal of this project is to obtain more precise estimates of the lunar heat flow in these regions by using modern analysis techniques that would have been deemed computationally infeasible at the time these data were collected.

In the final publication by the Apollo Heat Flow Experiment team, the heat flow was estimated in a two-step approach. First, the thermal diffusivity was estimated by the attenuation with depth of the annual thermal wave. Second, the mean temperature profile was estimated by removing the diurnal, annual, and short-term transient signatures from these temperature series. The heat flow was then obtained by multiplying the temperature gradient by the thermal conductivity. This analysis neglected other periodicities, and we have found that the 18.6-year precession of the lunar orbit strongly affects the subsurface temperatures over the entire depth range of the heat flow experiment. In particular, the annual peak-to-peak difference in maximum monthly surface temperatures varies from ˜4 to 8 K over an ˜18 year time span.

The lunar heat flow will be constrained by using a forward modeling approach. By use of the JPL ephemerides, and knowledge of the surrounding topography, we have constructed a radiation model of the Apollo 15 and 17 sites. By using this as an input, and by solving the time dependent heat-conduction equation, thermal conductivity profiles and lunar heat flows that are consistent with the observations will be obtained.