

Recent Findings from Restored Apollo Magnetic Field Records

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On November 19, 1969, Apollo 12 astronauts installed a Lunar Surface Magnetometer (LSM) as a part of the Apollo Lunar Surface Experiment Package, making the first magnetic field measurement on a planetary body other than Earth. The subsequent Apollo missions deployed two more LSM's (Apollos 15 and 16), two Lunar Portable Magnetometers (Apollos 14 and 15), and two Sub-satellite Biaxial Magnetometers (SBMs of Apollos 15 and 16). After almost a half century, the Apollo 15 and 16 missions are still the only lunar missions conducting simultaneous surface and orbital magnetic field experiments. The Apollo magnetic field experiments enabled many first discoveries, including the lunar magnetic anomalies and the electrical conductivity of the Moon. Since the Apollo era, the archaic data format has been hampering the re-examination of Apollo magnetic field records until recently. We have now restored most of the digital Apollo magnetic field records archived at NSSDC, including the 0.3-s data from the Apollo 12, 15 and 16 LSMs and the 24-s data from Apollo 15 and 16 SBMs. The restored LSM data have revealed many narrowband ion cyclotron waves in the Earth's magnetotail that were not investigated during the Apollo years. The restored data also allow re-analyses of the magnetic sounding of the lunar interior and Moon-solar wind interaction. We find that the observed transfer function responses in both tangential and radial components on the lunar surface are consistent with theoretical expectations at least for frequencies greater than 10^{-4} Hz. The comparison between SBM and LSM data indicates that, when the Moon is in the solar wind, the surface magnetic field is slightly enhanced on the sunward side. This presentation summarizes the recent findings from the restored Apollo magnetic field data and, based on these results, infers the expectations and unexplored topics for magnetic field measurements by future lunar surface missions.

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