Available online at www.sciencedirect.com
SciVerse ScienceDirect
Advances in Space Research 50 (2012) 1581–1582
ADVANCES IN SPACE RESEARCH (a COSPAR publication)
www.elsevier.com/locate/asr

Preface

Recent results on lunar exploration and science

The Moon is our nearest celestial neighbor, viewed by man from ancient times, viewed in more detail by telescope for centuries and been explored by humans since the 1960's. Many scientific results and our knowledge of the Moon have been obtained from the lunar missions over the past 50 years. The Apollo lunar missions returned a wealth of data, e.g., lunar rocks and minerals, orbital remote sensing, and field mapping by astronauts. The sample return missions and Soviet robotic rovers have contributed substantially to our understanding of the Moon. The successful landing of the Apollo 11 mission in 1969 was a scientific milestone. Since that historic event, scientists have strived to more fully understand the chemistry, mineralogy and rock types of the Moon; however, the Moon still has long-standing or unsolved questions relating to the origin, formation, evolution, environments, magnetization, and deep interior as well as surface processes and possible life. Recently, several countries have explored the lunar surface for the source of economic minerals and to understand the early development of the Earth and other planets. The important recent lunar exploration missions are *Japan's Kaguya* (*SELENE*) launched on September 14, 2007 to obtain scientific data of the lunar origin and evolution and to develop the technology for the future lunar exploration, China's Chang'E-1 Lunar Orbiter launched on October 24, 2007 to study the lunar environment and 3-D surface topography, India's orbital satellite Chandrayaan-1 launched on October 22, 2008, and USA's Lunar Reconnaissance Orbiter/Lunar Crater Observation and Sensing Satellite (LRO/LCROSS) launched on June 18, 2009 to search for water ice in a permanently shadowed crater near one of the Moon's poles. These missions provide new opportunities to explore and understand space environments, surface processes, interior structure and the origin of the Moon.

The papers in this issue of *Advances in Space Research* present the latest results from recent lunar missions, including lunar gravity and magnetic field, atmosphere, surface geomorphology, volcano, craters, internal structure, water and life science as well as comparative studies with the atmosphere, surface and interior of Earth. A sample of papers in this issue of *ASR* includes:

(1) *Lunar plasma environment and magnetic anomalies*. Lipatov and colleagues present an asymmetry of the Mach cone due to mass loading, the upstream flow density distribution and the magnetic field of the Moon. The pickup ions form asymmetrical plasma tails that may disturb the lunar plasma wake. Furthermore, the Moon is considered as a weakly conducting body.
(2) *Lunar topography and geology*. Kim and colleagues show that the lunar surface rock materials (including ancient crater materials, mare basalts, and possible South Pole-Aitken basin region impact melt) are slightly elevated in K and Th with respect to the rest of the Moon. The oldest surfaces of the South Pole-Aitken basin region are found to be oxygen-depleted during the heavy bombardment period relative to later stages of geologic development.
(3) *Origin and stability of lunar polar volatiles*. Berezhnoy and colleagues show the existence of volatile species in the Cabeus crater considered as one of the coldest lunar polar craters from LCROSS. The species in the Cabeus crater as well as CH_4 and CO clathrate hydrates except H_2, CO, and CH_4, are stable against evaporation at the LCROSS impact site. C-rich comets are main sources of CH_4, and C_2H_4.
(4) *Lunar landing sites and sample return*. Flahaut and colleagues identified 29 sites that best fulfill two important scientific goals: to determine the extent and composition of the primary feldspathic crust, (ur) KREEP layer, and other products of differentiation and to find the variety, age, distribution and origin of lunar rock types.
(5) *Physical libration of the Moon*. Petrova and colleagues developed the inverse problem of lunar physical libration. They found that the selenographic coordinates of polar stars were insensitive to longitudinal librations $\tau(t)$, and sensitive to Love number k2 and t anelastic time delay.

Each of the papers included in this issue went through a formal review process. We thank the contribution of each

http://dx.doi.org/10.1016/j.asr.2012.09.010

author and extend our gratitude to all the referees; those who agreed to be identified by name are listed at the end of this issue. The assistance of Peggy Ann Shea, *ASR* Co-editor for Special Issues, the Elsevier editorial office, and COSPAR is highly appreciated.

Guest Editor
Shuanggen Jin
Shanghai Astronomical Observatory,
Chinese Academy of Sciences,
Shanghai 200030, China
E-mail address: sgjin@shao.ac.cn

Available online 18 September 2012