Planetary Geodesy
and
Remote Sensing

EDITED BY **Shuanggen Jin**

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Preface

The planetary science is dedicated to exploring the origin, formation, and evolution on Mercury, Venus, Earth, Moon, Mars, Saturn, and Jupiter..., and seeking life beyond Earth. The planetary exploration provides most important direct observations and constraints on planetary structure and dynamics as well as evolution, particularly planetary geodesy and remote sensing, for example, Very Long Baseline Interferometry, Laser Ranging, Laser Altimetry, microwave radiometers, Mineralogy Mapper, and other sensors. In the 1960s, the United States made its first attempt to obtain closer images of lunar surface with Ranger series, and particularly the successful landing of the lunar Apollo 11 mission in 1969 was a scientific milestone. After that, more and more explorations on the moon, Mars, Venus, Jupiter…, have been conducted over the world, such as the recent lunar SMART-1, SELENE, ChangE-1/2/3, Chandrayaan-1, LRO/LCROSS and GRAIL, Mars Global Surveyor, Mars Express, Mars Odyssey, Mars Reconnaissance Orbiter, Venus Express, Phoenix, and planning missions. These explorations provided new understanding and insights on the planetary atmosphere, space environments, surface processes, evolution and interior structure, as well as dynamics.

However, the recent results from various missions are challenging our previous understanding on the moon and other planets, such as the identification of ice, OH/H_2O, and new mineral components. For example, the early results showed that the moon and some planets have practically no atmosphere and lost its thermal energy in the initial stages of formation, so it has undergone meager change from its earlier formation unlike Earth, which has undergone drastic changes. Therefore, Moon and other planets have lots of long-standing questions, such as planetary environments, origin, formation and evolution, magnetization of crustal rocks, internal structure, and possible life. Furthermore, the high-resolution topography, gravity and magnetic field, surface processes, and interior activities of planets are not clear. One of the main factors is the lack of high-precision and -resolution geodetic and remote-sensing techniques. The planetary geodesy and remote sensing, with higher spatial and spectral resolution, from recent planetary missions provided new opportunities to explore and understand Moon and planets in more detail. In this book, the methods and techniques of planetary geodesy and remote sensing are presented as well as scientific results on probe orbit, topography, gravity field, crustal thickness, mineral components, major elements, clinopyroxene, and physical libration of planets.

This book provides the main techniques, methods, and observations of planetary geodesy and remote sensing as well as and their applications in planetary science for planetary explorer and researchers who have geodetic

and remote-sensing background and experiences. Furthermore, it is also useful for planetary probe designers, engineers, and other users' community, for example, planetary geologists and geophysicists. This work is supported by the National Basic Research Program of China (973 Program) (grant no. 2012CB720000) and Main Direction Project of Chinese Academy of Sciences (grant no. KJCX2-EW-T03). Meanwhile, we would like to gratefully thank the Taylor & Francis/CRC Press for their processes and cordial cooperation to publish this book.

Shuanggen Jin
Shanghai Astronomical Observatory
Chinese Academy of Sciences
Shanghai, China

Biography

Shuanggen Jin is professor at the Shanghai Astronomical Observatory, CAS. He completed B.Sc. degree in Geodesy/Geomatics from Wuhan University in 1999 and Ph.D. degree in GNSS/Geodesy from University of Chinese Academy of Sciences in 2003. His main research areas include Satellite Navigation, Remote Sensing, Satellite Gravimetry, and Space/ Planetary Sensing. He has written over 200 papers in JGR, IEEE, EPSL, GJI, JG, Proceedings, etc., five books/monographs, and has five patents/software copyrights. He is the President of the International Association of Planetary Sciences (IAPS) (2013–2015), Chair of the IAG Sub-Commission 2.6 (2011–2015), Editor-in-Chief of International Journal of Geosciences, Associate Editor of Advances in Space Research (2013), and Editorial Board member of Journal of Geodynamics and other six international journals. He has received many awards during his career; they are Special Prize of Korea Astronomy and Space Science Institute (2006), 100-Talent Program of Chinese Academy of Sciences (2010), Fellow of International Association of Geodesy (IAG) (2011), Shanghai Pujiang Talent Program (2011), Fu Chengyi Youth Science and Technology Award (2012), Second Prize of Hubei Natural Science Award (2012), Second Prize of National Geomatics Science & Technology Progress Award (2013), Liu Guangding Geophysical Youth Science & Technology Award (2013), etc.

Contributors

Sundaram Arivazhagan
Department of Geology
Periyar University
Salem, India

Misha Barkin
Moscow Aviation Institute
Moscow, Russia

Yuri Barkin
Sternberg Astronomical Institute
Moscow State University
Moscow, Russia

Shengbo Chen
College of Geoexploration Science
    and Technology
Jilin University
Changchun, China

Kaichang Di
State Key Laboratory of Remote
    Sensing Science
Institute of Remote Sensing and
    Digital Earth
Chinese Academy of Sciences
Beijing, People's Republic of China

Jose Ferrandiz
University of Alicante
Alicante, Spain

Jian Guo
Department of Land Surveying and
    Geo-Informatics
The Hong Kong Polytechnic
    University
Kowloon, Hong Kong

Pengju Guo
College of Geoexploration Science
    and Technology
Jilin University
Changchun, China

Hideo Hanada
National Astronomical Observatory
    of Japan
Mizusawa, Japan

Daniel Heyner
Institute for Geophysics and Extra
    Terrestrial Physics
TU Braunschweig
Braunschweig, Germany

Han Hu
Department of Land Surveying and
    Geo-Informatics
The Hong Kong Polytechnic
    University
Kowloon, Hong Kong

and

State Key Laboratory of Information
    Engineering in Surveying
Mapping and Remote Sensing
Wuhan University
Wuhan, People's Republic of China

Hauke Hussmann
DLR Institute of Planetary Research
Berlin, Germany

Shuanggen Jin
Shanghai Astronomical Observatory
Chinese Academy of Sciences
Shanghai, China

Fei Li
State Key Laboratory of Information
    Engineering in Surveying
Mapping and Remote Sensing
Wuhan University
Wuhan, China

Yanqiu Li
College of Geoexploration Science
    and Technology
Jilin University
Changchun, China

Yi Lian
College of Geoexploration Science
    and Technology
Jilin University
Changchun, China

Bin Liu
State Key Laboratory of Remote
    Sensing Science
Institute of Remote Sensing and
    Digital Earth
Chinese Academy of Sciences
Beijing, People's Republic of China

Yiliang Liu
State Key Laboratory of Remote
    Sensing Science
Institute of Remote Sensing and
    Digital Earth
Chinese Academy of Sciences
Beijing, People's Republic of China

Ming Ma
College of Geoexploration Science
    and Technology
Jilin University
Changchun, China

Koji Matsumoto
RISE Project
National Astronomical Observatory
    of Japan
Oshu, Japan

and

National Astronomical Observatory
    of Japan
Mizusawa, Japan

Zhi-guo Meng
College of Geoexploration Science
    and Technology
Jilin University
Changchun, China

Man Peng
State Key Laboratory of Remote
    Sensing Science
Institute of Remote Sensing and
    Digital Earth
Chinese Academy of Sciences
Beijing, People's Republic of China

Robert Tenzer
School of Geodesy and Geomatics
Wuhan University
Wuhan, China

Jingran Wang
College of Geoexploration Science
    and Technology
Jilin University
Changchun, China

Erhu Wei
School of Geodesy and Geomatics
Wuhan University
Wuhan, China

Johannes Wicht
Max Planck Institute for Solar
    System Research
Kaltenburg-Lindau, Germany

Bo Wu
Department of Land Surveying and
    Geo-Informatics
The Hong Kong Polytechnic
    University
Kowloon, Hong Kong

Yunzhao Wu
School of Geographic and
    Oceanographic Sciences
Nanjing University
Nanjing, China

Yansong Xue
Shanghai Astronomical Observatory
Chinese Academy of Sciences
Shanghai, China

Jianguo Yan
RISE Project
National Astronomical Observatory
    of Japan
Oshu, Japan

and

State Key Laboratory of Information
    Engineering in Surveying
Mapping and Remote Sensing
Wuhan University
Wuhan, China

Wei Yan
National Astronomical
    Observatories
Chinese Academy of Sciences
Beijing, China

Tengyu Zhang
Shanghai Astronomical Observatory
Chinese Academy of Sciences
Shanghai, China

Ying Zhang
College of Geoexploration Science
    and Technology
Jilin University
Changchun, China

Ying Zhao
College of Geoexploration Science
    and Technology
Jilin University
Changchun, China