

JP 2.1: Geodetic Planetology (JP-GP)

Chairs: Oliver Baur (Austria) and Shin-Chan Han (USA)

Terms of Reference

Precise knowledge about the thermal evolution, composition, shape and dynamics of extra-terrestrial bodies is increasingly accessible from science data collected by space-geodetic methods. With growing opportunities from the past, current and future satellite missions to the planets of the solar system and other bodies in outer space, it is timely to explore various space-geodetic theory and methodologies to enhance the scientific return of the planetary missions for improved understanding of the planets or satellites.

In the last decades, geodetic planetology has experienced considerable advance. Data collected by spacecraft orbiting the Earth's moon (e.g., Lunar Prospector, SELENE/Kaguya, Lunar Reconnaissance Orbiter), Mars (Mars Global Surveyor, Mars Odyssey, Mars Reconnaissance Orbiter), Venus (Magellan), and Mercury (Messenger) revealed increasingly detailed structures of the gravity field, shape, surface and atmosphere of these celestial bodies. Forthcoming missions to the Earth's moon (GRAIL), Mercury (BepiColombo), Jupiter (JUNO), and the Jovian system (EJSM-Laplace) will ensure ongoing progress. The space-geodetic methods used in planetary geodesy include range and range-rate orbit tracking, VLBI, altimetry, and photogrammetric remote sensing; these observation techniques are well-known from terrestrial applications.

The main motivation to constitute a Joint Project on Geodetic Planetology (JP-GP) within the IAG is the scientific proximity of planetary geodesy to the activities of the IAG Commissions, the ICCT and the IAG services. This proximity particularly holds to Commission 1 (Reference Frames), Commission 2 (Gravity Field), Commission 3 (Earth Rotation and Geodynamics), and the ICCT. High-accuracy determination of reference frames is the basis for the quantification of dynamic processes on and beneath a body's surface, the detection of variations in its rotational behavior and precise orbit determination of satellites. The gravity field is a key quantity to assess information on a body's composition and interior structure; furthermore, knowledge about the gravity field allows for the tailored orbit design of artificial satellites, for instance with regard to robotic and human landing. Rotation characteristics of celestial bodies include length-of-day variations, polar motion, precession, nutation or libration. These areas of research require sophisticated physical and mathematical modeling in the framework of a concise theoretical background. In summary, promoting geodetic planetology is an inter-disciplinary effort, and hence demands for collaboration with all IAG components.

Within the 4-year horizon 2011-2015, the JP-GP will start to initiate and promote geodetic research of extra-terrestrial

bodies. Furthermore, in terms of sustainable follow-on activities, the project envisages the establishment of an Inter-Commission Committee on Geodetic Planetology for the next period 2015-2019. Towards that goal, the JP-GP aims to:

- support scientific activities related to the gravity field and orbit determination, topography, physical shape (geoid), interior structure and rotation characteristics of planetary bodies, together with the establishment and maintenance of reference frames;
- encourage the cooperation between the terrestrial geodesy and planetary geodesy communities by promoting the exploitation of synergies;
- provide an international platform for the transfer of knowledge and experience on geodetic theory and data analysis including radio science, altimetry, and stereo images;
- coordinate interdisciplinary research activities.

Organization

The JP-GP is joint with the ICCT and the Commissions 1, 2, and 3, with Commission 2 being the lead commission. The activities of the JP-GP are coordinated by a Steering Committee consisting of the President, the Vice President, representatives from the Commissions 1, 2, and 3 (one representative from each commission), and a representative from the ICCT.

Objectives

The main objective of the JP-GP is to initiate and promote geodetic research of extra-terrestrial bodies. In particular, the JP-GP will

- act as a framework for geoscientific discussion and cooperation concerning the study of the planets of the solar system and other bodies in outer space;
- promote the integration of advanced space-geodetic methods for planetary purposes, including the development of tailored methodologies for data exploitation and interpretation;
- support interdisciplinary activities of the ICCT in geodetic theory and data analysis;
- help to develop future geodetic technologies and mission designs for planetary geodesy;
- explore the possibility of sustainable collaboration with the IAU/IAG Working Group on Cartographic Coordinates and Rotational Elements (WGCCRE)
- establish an Inter-Commission Committee on Geodetic Planetology for the period 2015-2019.

Output

The outputs after the 4-year time frame 2011-2015 are:

- Establishment of geodetic planetology within the IAG;
- Organization of a Workshop with interdisciplinary

emphasis;

- Establishment of an Inter-Commission Committee on Geodetic Planetology for the period 2015-2019.

Steering Committee

Chair: Oliver Baur (Austria)

Vice Chair: Shin-Chan Han (USA)

Commission 1 Representative: Tonie van Dam (Luxembourg)

Commission 2 Representative: Urs Marti (Switzerland)

Commission 3 Representative: Richard Gross (USA)

ICCT Representative: Nico Sneeuw (Germany)

Members

Markus Antoni (Germany)

Brent Archinal (USA)

Ali Ardalan (Iran)

Georges Balmino (France)

Veronique Dehant (Belgium)

Shuanggen Jin (China)

Anno Löcher (Germany)

Jürgen Müller (Germany)

Nico Sneeuw (Germany)

Dimitrios Tsoulis (Greece)

Pieter Visser (Netherlands)