United Nations Educational Scientific and Cultural Organization , UNESCO
International Astronomical Union, IAU
Russian Academy science, RAS
Republic Tatarstan government
Tatarstan Academy science, AN RT
Kazan State University, KSU
Institute of astronomy RAS
Russian National Commission for UNESCO
Russian Foundation for Basic Research, RFBR

INTERNATIONAL CONFERENCE "ASTRONOMY AND WORLD HERITAGE: ACROSS TIME AND CONTINENTS"

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International conference "Astronomy and world heritage: across time and continents" are organized official under the aegis of UNESCO.

On 20 December 2007, the United Nations 62nd General Assembly proclaimed 2009 the International Year of Astronomy. UNESCO was designated as the lead agency and focal point for the Year. As noted by the UNESCO General Conference at its 33rd session, the UNESCO Thematic Initiative "Astronomy and World Heritage" contributes to the preparation of the International Year of Astronomy, and will provide an opportunity to raise public awareness, especially with young people, about the safeguarding of scientific heritage, and to enhance the links between science, education and culture. During the opening ceremony of the International Year of Astronomy, which took place on 15 January 2009, the Director-General of UNESCO officially launched the cycle of activities "Astronomy and World Heritage: *across time and continents*". *One of the main activities of this cycle is the* International Conference on "Astronomy and World Heritage: across time and continents", to be hosted by the Government of the Republic of Tatarstan (Russian Federation) 20 – 24 August 2009. The role of astronomy on population of different continents, the importance of the astronomical heritage world-wide, in terms of its enrichment of the history of humanity, the promotion of cultural diversity and the enhancement of international exchange, and the fundamental role that culture plays in scientific progress and science are reflected in Congress items. Within the framework of Congress also the following activity were organized also: International conference: "Near Earth astronomy – 2009"; International Scientific Symposium: "The Moon, moons and planets: Investigation and Exploration"; School – conference for students and schoolboys: "Astronomy in modern world and education".

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the inner part of polar craters, but at the smooth plains too. According to data from Kaguya these areas are characterized by rough topography and numerous small craters. These regions are coincide with larger number of small areas with high hydrogen content, discovered by Lunar Prospector [8] and may contain deposits of volatile elements. With the use of the Kaguya information, quantitative illumination maps of the Lunar South Polar Region were compiled too. Distance between points in this digital database obtained is equal 0.25 degrees along latitude and 1 degree along longitude.

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THE VECTOR APPROACH TO THE LUNAR PHYSICAL LIBRATION

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The new analytical approach to the problem of physical libration of the rigid Moon taking account of perturbations from the Earth and the Sun is developed. The Euler's equations are added by twelve kinematic equations. Movement is described by fifteen variables that makes this method more informative and flexible in comparison with traditional ones. After transformations and linearization the system from nine non-uniform linear differential equations of the first order breaks up on two groups, even one and odd in relation to reflection in a plane of lunar equator. The general rotational oscillations of the Moon are superposition of independent longitude and latitude librations.

The libration on longitude is presented by three equations for "free" (ore unrestricted) and forced oscillations. The first have the period 2.8785 *Jul. year* (and the amplitude 1.855"). The forced physical libration of the Moon on a longitude is presented by periods $T_2 = 27.2011$ *d.* (15.30"), the sidereal year (0.090") and the half-year (17.626") and third of year (0.050") (together five harmonics). Influence of the Sun on these oscillations is comparable with Earth one.

Physical libration on latitude is presented by six equations, and at the account of influence only from the Earth is described by two harmonics of the unrestricted (T_5 « 74.180 *Jul.y.*, T_6 = 27.347 *d.)* and forced oscillations $T_3 = 27.212$ *d.* Movement of a true pole is presented by same harmonics; two last oscillations give beating with the external 48.62 *Jul. y.* and internal *T7* = 27.389 *d.* periods. The maximal deviation of true pole is 45.3". One of frequencies is equal to zero and gives the stationary solution with an inclination to the south of a long Moon axis. The third law Cassini is theoretically confirmed. For the important relation $\frac{5I}{B}$ & 0.2311 the theory gives 0.2319, that confirms adequacy of the developed method.

Revision of the former theory is made. For the Moon is not exist free (Euler's) oscillations, and instead of the oscillations with the period *T* « 148.167 *Jul.y.* actually there is a harmonic with T_5 « 74.180 *Jul. y.* Application to the Moon (Melchior and others) of the kinematic

Poinsot method with result in 22" between an instant axis of rotation and the smallest axis of inertia of the Moon is only rough approximation, our dynamic calculation gives 45".

SPACECRAFT OBSERVATIONS OF MARS: RECENT ACHIEVEMENTS AND PLANS FOR THE FUTURE

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A review talk will be dedicated to remote observations of Mars, in particular related to its atmosphere and climate.

A success of Viking mission has revealed a new picture of Mars of that time, as described in Arizona Mars book. Then, up to 1996, a long gap in Mars missions has been only interrupted by brief Phobos-2 operations in 1989. Two large ambitious missions, NASA Mars Observer in 1992 and Russian Mars 96 were unsuccessful. A new page in Mars observation started with first recovery mission of Mars Observer, Mars Global Surveyor (MGS) launched by NASA in 1996 and operated almost ten years from 1997 to 2006. Major discoveries of MGS are as follows: 1) Remnant magnetization of Martian crust was discovered by magnetometer experiment; 2) Figure of Mars, its global altimetry by MOLA lidar revealed global dichotomy of Mars hemispheres, and formed a basis for numerous studies; 3) Systematic measurements of main atmospheric parameters (atmospheric temperature profiles, dust loading and ice clouds, water vapour contents) with infrared Fourier-transform spectrometer TES allowed to monitor Martian climate during three Martian years from 1997 through 2004.

Mars Odyssey NASA orbiter, launched in 2001 discovered vast quantities of permafrost, or water-bounded minerals in polar, and even in low-latitude regions of Mars with neutron spectrometer HEND and gamma-ray spectrometer GRS. High resolution thermal-emission instrument THEMIS dedicated to the search of hot spots on Mars, which would be a signature of present volcanic activity has not discovered any.

In 2003 ESA has undertaken an effort to recover most of orbital science of Mars-96 with Mars Express mission. Mid-IR mapping spectrometer OMEGA on Mars Express has not detected any significant carbonates on the surface of Mars suggesting a new look on its early "wet" history. Local detection of hydrated material on very old terrains led to conclusion that the wet period in Mars history ended as early as 3.9 Ga, possibly followed by a volcanic catastrophe. This study is to large extent supported by Mars Express high-resolution stereo camera (HSRC) observations, which nearly completed global imaging of Mars, partially obtained by MOC on MGS. MARSIS radar measured the Atmosphere-dedicated instruments of Mars Express, such as SPICAM and PFS provided a wealth of details on Mars atmospheric structure, chemistry and climate. In particular, simultaneous measurements of water vapour in the atmosphere with three different instruments on Mars Express allowed to compare results, converge measurements, and to correct Viking and MGS results. Experiment ASPERA on Mars Express, a dedicated atmospheric escape suite, provided first experimental constraints on present escape rates.

The discovery of methane on Mars, first announced by PFS team in 2004 and confirmed by two independent ground-based astronomy teams, is of major importance. Methane is detected at the level 10-50 ppb (parts per billion) and appears variable with time and geographic location. Photochemistry gives a sharp estimation of methane lifetime on Mars of 300-400 years, which, with any quantity of gas requires an unknown source. On the other hand, it is too long to explain observed variability and requires an unknown destruction mechanism. Still, all measurements of methane are on the edge of the detection, and more precise methods are anticipated.