

# Soviet and Japanese Aerospace Literature

Throughout 1990 the *AIAA Journal* will carry selected abstracts on leading research topics from the Soviet aerospace literature and, as space permits, from similar Japanese literature. The topics will be chosen and the abstracts reviewed for pertinency by *AIAA Journal* editors. This month features Planetary Exploration from the USSR and The Global Positioning System from Japan.

Support for assembling and publishing the selected abstracts has been provided by the Innovative Science and Technology Directorate of the Strategic Defense Initiative Organization (SDIO), with the sponsorship and technical management of the abstract service by the Office of Naval Research (ONR) under ONR Grant N0014-87-6-0137.

Abstracts in this listing have been taken from the semimonthly abstract journal International Aerospace Abstracts (IAA), published by the American Institute of Aeronautics and Astronautics (AIAA) in cooperation with the National Aeronautics and Space Administration (NASA) under Contract No. NASW-4373. Additional material can be obtained through searching the Aerospace Database – available online via DIALOG or NASA RECON.

Paper copies and microfiche of the original documents cited are available from AIAA Library, Technical Information Service, American Institute of Aeronautics and Astronautics, Inc., 555 W. 57th St., New York, NY 10019 (212) 247-6500, ext. 231. Use the "A" number to identify material you want. Please be advised that most of the original documents are in the original language. Direct questions concerning this abstract section of the *AIAA Journal* to John Newbauer, AIAA Administrator, Technical Publications.

## Soviet Aerospace Literature This month: *Planetary Exploration*

**A90-36110** Determination of the elemental composition of Mars rocks from Phobos-2 (Opredelenie elementnogo sostava porod na Marse s KA 'Fobos-2'). I. A. SURKOV, L. P. MOSKALEVA, V. P. KHARIUKOVA, S. E. ZAITSEVA, G. G. SMIRNOV et al., *Pis'ma v Astronomicheskii Zhurnal* (ISSN 0320-0108), Vol. 16, April 1990, pp. 355-362. 6 Refs.

The Phobos-2 multichannel scintillation gamma-ray spectrometer was used to determine the composition of Mars rocks. This paper presents results of an analysis of gamma-ray spectra measured when the spacecraft was in PC-3 orbit. In the area investigated, the subalkaline basalt in the composition proves to be the closest terrestrial analog of the underlying Martian bedrocks.

**A90-36109** The Thermoscan experiment—Thermal scanning of the Mars surface from Phobos-2 (Eksperiment TERMOSKAN—Teplovaia s'emka poverkhnosti Marsa s KA 'Fobos-2'). A. S. SELIVANOV, N. K. NARAEVA, A. S. PANFILOV, I. U. M. GEKTIN, V. D. KHARLAMOV et al., *Pis'ma v Astronomicheskii Zhurnal* (ISSN 0320-0108), Vol. 16, April 1990, pp. 346-354. 10 Refs.

The thermal properties of the Mars surface were investigated via the Thermoscan twochannel scanning radiometer. Images of the near-equatorial regions of the Mars surface in the thermal and visible spectral bands are presented. Images of the shadow of Phobos on the Mars surface in the thermal spectral band were obtained for the first time on March 25, 1989. Surface brightness temperatures in the 180-280 K range and temperature gradients up to 20-30 K were measured.

**A90-34841** Indirect evidences for a gas/dust torus along the Phobos orbit. E. M. DUBININ, N. F. PISARENKO, S. V. BARABASH, A. V. ZAKHAROV, R. LUNDIN et al., *Geophysical Research Letters* (ISSN 0094-8276), Vol. 17, May 1990, pp. 861-864. Research supported by the Swedish Board for Space Activities and Academy of Finland. 10 Refs.

Observations from the Phobos-2 spacecraft of plasma and magnetic field effects in the solar wind near Mars suggest that a neutral gas torus/ring resides along the orbit of the Martian satellite Phobos. Strong decreases of the magnetic field strength coincident with strong plasma density increases are observed during the first elliptic transition orbits when the spacecraft approached the Phobos orbits. 'Torus effects' also have characteristics similar to the formation of a bow shock with increases of plasma density and ion temperature, and a characteristic deflection of the ion flow. This suggests a rather strong interaction between the solar wind plasma and plasma near Phobos orbit, similar to that of the solar wind with a comet.

**A90-36108** Ultraviolet observations of solar flares from Mars orbit (Ul'traioletovye nabludeniiia solnechnykh vspyshek s orbity Marsa). T. V. KAZACHEVSKAIA, L. L. BUKUSOVA, D. A. GONIUKH, A. I. LOMOVSKII, and I. U. N. TSIGEL'NITSKII, *Pis'ma v Astronomicheskii Zhurnal* (ISSN 0320-0108), Vol. 16, April 1990, pp. 343-345.

Observations of solar flares in the EUV region were carried out in March 1989 using the SUFR instrumentation on Phobos-2. A large (twofold) increase in the UV-radiation intensity in the flare observed on March 10 was found which was connected with an intense augmentation of the X-ray flux (class X4.5).

**A90-36107** Results of the Phobos-2 study of solar brightness oscillations (Rezultaty issledovaniia otsilliatsii iarkosti solntsa s borta mezhplanetnoi stantsii 'Fobos-2'). A. V. BRUNS, S. M. SHUMKO, R. BONNET, J. P. DELABOUDINIER, and C. FROHLICH, *Pis'ma v Astronomicheskii Zhurnal* (ISSN 0320-0108), Vol. 16, April 1990, pp. 330-342. 7 Refs.

Phobos-2 observations indicate that the variations in the power spectrum of 5min oscillations of the sun appear independently for each of the modes and have the character of 4-5-hour amplitude bursts. In general, the power spectrum lines reveal both quiet and active periods. The quiet periods are characterized by a brightness burst amplitude of (1.5-2) x 10 to the -7th and have a lifetime from about 10 hours to a few days. The active spectrum consists of a single burst or a sequence of bursts with an amplitude 30-50 times higher and lasting from a few hours to one day.

**A90-22793** Structural irregularities of the upper layers of the Martian cryolithosphere (Neodnorodnosti stroeniia verkhnikh sloev kriolitofery Marsa). R. O. KUZ'MIN, N. N. BOBINA, E. V. ZABALUEVA, and V. P. SHASHKINA, Space chemistry and comparative planetology; International Geological Congress, Session, 28th, Washington, DC, July 9-19, 1989, Reports (A90-22785 08-91). Moscow, Izdatel'stvo Nauka, 1989, pp. 80-95. 41 Refs.

Irregularities of the upper layers of the Martian cryolithosphere were revealed in a study of the morphological and morphometric characteristics of fresh impact craters. Maps of the roof depths of ice-bearing rocks and a set of section maps of relative ice content as a function of depth were compiled. The information obtained points to the existence of a marked latitudinal dependence both in the location of the roof depth of the ice-bearing rocks and in the ice distribution on it. An asymmetric pattern of the structure of the cryolithosphere in the southern and northern hemisphere is observed.

**A90-36106 Images of the sun obtained with the Terek X-ray telescope on Phobos-1 (Izobrazheniia solntsa, poluchennye rentgenovskim teleskopom TEREK na KA 'Fobos-1').** I. I. SOBEL'MAN, I. A. ZHITNIK, B. VALNICEK, M. RYBANSKY, M. BERNAS et al., *Pis'ma v Astronomicheskii Zhurnal* (ISSN 0320-0108), Vol. 16, April 1990, pp. 323-329. 7 Refs.

With the Terek telescope, normal-incidence multilayer mirrors in conjunction with CCD-based imaging detectors were used for imaging in the He II resonance line (304 Å) and the Fe IX-XI ion lines (170-180 Å). Traditional grazing-incidence optics were used for imaging in the 5-25-Å range. During the operation of the spacecraft, 140 X-ray images of the sun were obtained with an angular resolution up to 15 arcsec.

**A90-36105 First results of the ISM experiment (Pervye rezul'taty eksperimenta ISM).** J. P. BIBRING, M. COMBES, Y. LANGEVIN, C. CARA, P. DROSSART et al., *Pis'ma v Astronomicheskii Zhurnal* (ISSN 0320-0108), Vol. 16, April 1990, pp. 318-322. 7 Refs.

The ISM infrared imaging spectrometer on Phobos-2 provided about 40,000 spectra of Mars and Phobos in the 0.76-3.14-micron range. This paper presents the first results on the surface altimetry of Mars, the mineralogy of Mars and Phobos, and the trace constituents of the Mars atmosphere.

**A90-36103 A brief history of the mission to the Phobos (Kratkaia istoriia ekspeditsii k Fobosu).** R. Z. SAGDEEV and A. V. ZAKHAROV, *Pis'ma v Astronomicheskii Zhurnal* (ISSN 0320-0108), Vol. 16, April 1990, pp. 293-301. 23 Refs.

Details of the Phobos mission are provided, with particular attention given to the characteristics of the space vehicles and the scientific instrumentation. Tables are given which provide the technical characteristics of instruments intended for the study of the Phobos surface and atmosphere, for the investigation of the plasma environment of Mars, for solar studies, and for the examination of the interplanetary medium over the earth-Mars trajectory.

**A90-34221 Accuracy of formulas for the intermediate orbit of a satellite (O tochnosti formul promezhutochnoi orbity sputnika).** N. V. EMEL'IANOV, *Astronomicheskii Zhurnal* (ISSN 0004-6299), Vol. 67, Mar.-Apr. 1990, pp. 400-408. 16 Refs.

The accuracy of intermediate-orbit formulas based on the solution of the generalized problem of two fixed centers is analyzed. Results obtained using this approach are compared with numerical-integration results for long periods of time. For an artificial earth satellite over a time period of 150 days, the accuracy of the formulas is not worse than 2.2 cm. For Phobos, the accuracy is 0.3 cm for a time period of 360 days.

**A90-27250 Space exploration—Ideas, priorities, and efficiency (Kosmicheskie issledovaniia—Idei, priority, effektivnost').** V. L. BARSUKOV, A. A. GALEEV, K. I. GRINGAUZ, A. I. DUNAEV, K. IA. KONDRAT'EV et al., *Akademiia Nauk SSSR, Vestnik* (ISSN 0002-3442), No. 2, 1990, pp. 79-117.

Several Soviet specialists in the field of astronautics were asked to assess the Soviet space program. In particular, they were asked the following questions: (1) why has the USSR lost its leading role in space exploration; (2) what specific measures could be taken to improve the performance of the Soviet space program; (3) what is the cost effectiveness of current space projects; and (4) should Soviet space organizations be restructured to improve efficiency. The specialists' answers to these questions are given.

**A90-24940 Cleopatra crater on Venus—Venera 15/16 data and impact/volcanic origin controversy.** A. T. BAZILEVSKII and B. A. IVANOV, *Geophysical Research Letters* (ISSN 0094-8276), Vol. 17, Feb. 1990, pp. 175-178. 19 Refs.

The morphology and morphometry of the 100-km diameter, 2.4-km deep Cleopatra crater on Venus are examined using Venera 15/16 images. The Cleopatra crater is compared to circular structures on Venus, Mercury, Mars, the earth and the moon. Consideration is given to the possible causes for the genesis of the Cleopatra crater. It is concluded that Cleopatra has a clear impact basin morphology with an anomalous crater depth.

**A90-15669 Possible effect of the condensation (on the surfaces of certain cosmic bodies) of impact-pyrolysis products of organic matter on the formation of the reflection spectra of these bodies (O vozmozhnom vliianii kondensatsii na poverkhnosti nekotorykh kosmicheskikh tel produktov udarnogo piroliza organicheskogo veshchestva na formirovanie ikh spektrov otrazheniia).** V. L. BARSUKOV, E. M. GALIMOV, L. A. KODINA, and N. E. DOMOGAROVA, *Akademiia Nauk SSSR, Doklady* (ISSN 0002-3264), Vol. 308, No. 5, 1989, pp. 1216-1219.

Spectrometry data are presented which indicate that the presence of an organic film on a black graphite surface leads to a significant and specific change in its optical properties. The pyrolysis of organic matter in a wide temperature range, characteristic of impact events, leads to the appearance of a large number of products, including free carbon, simple hydrocarbons like methane, and a whole spectrum of organic compounds of different molecular masses and structures. The results are of interest in explaining the albedo decrease in the UV region of certain dark cosmic bodies, such as Phobos and Deimos.

**A90-22792 Chemical weathering on Venus and Mars—Similarities and differences (Khimicheskoe vyvetrивanie na Venere i Marse—Skhodstva i razlichia).** M. IU. ZOLOTOV, Space chemistry and comparative planetology; International Geological Congress, Session, 28th, Washington, DC, July 9-19, 1989, Reports (A90-22785 08-91). Moscow, Izdatel'stvo Nauka, 1989, pp. 71-80. 35 Refs.

It is suggested that similarities of chemical compositions and physical properties of surface rocks on Mars and Venus are probably due to similarities of such chemical processes on the planetary surfaces as oxidation and sulfate formation governed by rock-atmosphere interaction. Recent chemical weathering on Venus is assumed to be localized in geologically young regions. The chemical composition of the Venusian atmosphere is presumably buffered by solid-phase equilibria at the planetary surface. Estimates of sulfur and chlorine inventories in weathered rocks on Venus and Mars point to the existence of a sink of volatiles in solid phases during the most ancient stages of the postaccretion histories of the planets.

**A90-22791 The CO<sub>2</sub> problem and the specific features of chemical weathering on Mars (Problema CO<sub>2</sub> i spetsifika khimicheskogo vyvetrивania na Marse).** IU. I. SIDOROV, Space chemistry and comparative planetology; International Geological Congress, Session, 28th, Washington, DC, July 9-19, 1989, Reports (A90-22785 08-91). Moscow, Izdatel'stvo Nauka, 1989, pp. 62-70. 52 Refs.

Outgassed CO<sub>2</sub>, H<sub>2</sub>O, and N<sub>2</sub> inventories locked in near-surface reservoirs on Mars are considered in relation to greenhouse-effect calculations. Results suggest that extremely cold climatic conditions dominated on Mars over almost the entire period of its postaccretion history. The absence of liquid water on the Martian surface and its low-temperature determined such features of chemical weathering as its locality, its discrete character, and its maximal intensity in the past.

**A90-18723 Volcanism and tectonics of Venus—Venera 15/16 results.** A. T. BASILEVSKII, M. A. IVANOV, V. P. KRIUCHKOV, A. A. PRONIN, and E. N. SLIUTA, (COSPAR, IAA, IAU, and IUGG, Plenary Meeting, 27th, Symposium, Workshops, and Topical Meetings on Smaller Solar System Bodies and Orbits, Espoo, Finland, July 18-29, 1988) *Advances in Space Research* (ISSN 0273-1177), Vol. 10, No. 3-4, 1990, pp. 125-135. 33 Refs.

Based on the radar survey of the Venus surface made by Venera 15/16 spacecraft, the volcanic and tectonic features on the Venus surface are described and interpreted in terms of the volcanism and the tectonic history of the planet. The survey included SAR images with 1 to 2 km spatial resolution, and altimetric measurements. The information obtained shows that Venus is much more endogenically dynamic than the moon, Mercury, or Mars but is less endogenically active than the earth. The results also confirm the earlier conclusions concerning the direct dependence of the scale and duration of internal activity of a planet on its size.

**A90-18706 A mobile lander-borne radar to investigate the subsurface of the planet Mars.** M. A. BALIKHIN, V. I. GAIDANSKII, P. J. CATTERMOLE, P. J. JENKINS, S. P. KINGSLEY et al., (COSPAR, IAA, IAU, and IUGG, Plenary Meeting, 27th, Symposium, Workshops, and Topical Meetings on Smaller Solar System Bodies and Orbits, Espoo, Finland, July 18-29, 1988) *Advances in Space Research* (ISSN 0273-1177), Vol. 10, No. 3-4, 1990, pp. 39-42. 9 Refs.

Revived interest in exploration of the planet Mars had led to a Soviet suggestion that a radar on the surface of the planet could be used for both subsurface and atmospheric studies. This paper reviews the present understanding of the electromagnetic properties of the Martian subsurface and the possibility of the presence of water. This is used in the development of the requirements for a radar sensor and an investigation into techniques such as aperture synthesis, needed to meet these requirements. Some techniques rely on motion of the radar, hence on the use of a Mars rover. A possible radar design is presented.

**A90-18704 Soviet plans for the exploration of Mars.** V. L. BARSUKOV, IU. A. SURKOV, and R. S. KREMNEV, (COSPAR, IAA, IAU, and IUGG, Plenary Meeting, 27th, Symposium, Workshops, and Topical Meetings on Smaller Solar System Bodies and Orbits, Espoo, Finland, July 18-29, 1988) *Advances in Space Research* (ISSN 0273-1177), Vol. 10, No. 3-4, 1990, pp. 25-33.

Program of Mars exploration up to the year 2000 is discussed. It consists of three stages: (1) global study of Mars surface, (2) the investigation of selected regions in detail, and (3) the delivery of Martian soil to the earth. The preliminary scientific payloads for Martian orbiter, rover, balloon and penetrator are considered.

**A90-17243 The electric field of an atmosphereless celestial body (Elektricheskoe pole bezatmosferного небесного тела).** V. V. POPOV, *Kosmicheskie Issledovaniia* (ISSN 0023-4206), Vol. 27, Sept.-Oct. 1989, pp. 777-781. 7 Refs.

The electric field of a body situated in the solarwind plasma and irradiated by solar electromagnetic radiation is investigated; calculations are presented for the Martian satellite Phobos. It is shown that the body acquires a positive charge under such conditions; the transient process time is calculated. The system of one-dimensional Vlasov-Poisson equations for the electric field is solved numerically using a model photoelectron distribution function, enabling the determination of possible coordinate dependences of potential and electron density.

**A90-18705 On the use of a mobile surface radar to study the atmosphere and ionosphere of Mars.** S. I. KLIMOV, V. V. KOPEIKIN, V. V. KRASNOSHEL'SKIKH, A. M. NATANZON, A. E. REZNIKOV et al., (COSPAR, IAA, IAU, and IUGG, Plenary Meeting, 27th, Symposium, Workshops, and Topical Meetings on Smaller Solar System Bodies and Orbits, Espoo, Finland, July 18-29, 1988) *Advances in Space Research* (ISSN 0273-1177), Vol. 10, No. 3-4, 1990, pp. 35-38. 15 Refs.

It has been suggested in a previous paper that a simple pulsed radar be included on a future Mars Lander mission to look at the subsurface of Mars. It is apparent that the transmitter and aerials used will radiate power upwards as well as downwards and this will present an opportunity to investigate the upper atmosphere of Mars by radar techniques. As the available power is limited it is suggested that the technique of meteor wind radar be used at higher frequencies, and spaced antenna drift using total reflection at the ionosphere, at lower frequencies. The frequencies available from the radar will also be suitable for trans-ionosphere sounding.

**A90-17239 Experimental data on the plasma shells of Mars, Venus, and Comets Halley and Giacobini-Zinner—Comparison of loading effects (Eksperimental'nye dannye o plazmennyykh obolochkakh Marsa, Veneri i komet Galleia i Dzhakobini-Zinnera—Svravnenie effektivov nagruzheniia).** O. L. VAISBERG, V. N. SMIRNOV, G. N. ZASTENKER, and A. O. FEDOROV, *Kosmicheskie Issledovaniia* (ISSN 0023-4206), Vol. 27, Sept.-Oct. 1989, pp. 748-760. 40 Refs.

Data from a variety of interplanetary probes (Mars, Venera, ICE, and Vega) are examined in order to study the interaction between the solar wind and the atmospheres of Mars and Venus, and Comets Halley and G-Z. It is shown that this interaction leads to the formation of a plasma mantle around the planets or comets, with a sharply defined boundary between it and the solar wind. Attention is given to possible physical mechanisms leading to the formation of a sharp boundary between the mantle and the outer stream. The mantle formed in the daytime sector is topologically connected with the plasma tail.

**A90-15869 The successes of Phobos-2.** IURII ZAITSEV, *Spaceflight* (ISSN 0038-6340), Vol. 31, Nov. 1989, pp. 374-379.

Data obtained from the Phobos mission are described. The mission involved studies during the cruise between earth and Mars, with Mars, and with Phobos. Consideration is given to the examination of solar X-ray emissions during the Terek experiment; the analysis of solar activity using the various photometers and spectrometers; and the study of gamma-ray bursts. Observations of the plasma components of Mars and thermal images of the planet's surface are examined. A description of the instruments used to obtain photographs of Phobos and the analysis of the data are presented.

**A90-13567 The Mars balloon system for the Mars 1994 missions.** V. M. LINKIN, V. V. KERZANOVICH, V. M. KOVTUNENKO, R. S. KREMNEV, G. N. ROGOVSKII et al., 40th IAF International Astronautical Congress, Malaga, Spain, Oct. 7-13, 1989. 9 pp. 13 Refs., (IAF Paper 89-488).

The general requirements, balloon and payload options, baseline concept and guiderope subsystem of the Mars 1994 mission are discussed. The mass budget and a flight simulation profile are shown. A block diagram of the science and control equipment is presented.

**A90-13564 Unified automatic spacecraft for exploration of the remote solar system planets, interplanetary medium and sun.** IU. N. KOPTEV, V. M. KOVTUNENKO, R. S. KREMNEV, N. A. MOROZOV, O. V. PAPKOV et al., 40th IAF International Astronautical Congress, Malaga, Spain, Oct. 7-13, 1989. 12 pp., (IAF Paper 89-478).

A general discussion is presented of trajectories and configurations of spacecraft exploring Jupiter and the sun. A possible mission profile to the sun is addressed in some detail. The equipment needed aboard a spacecraft on a solar mission is described.

**A90-13425 The perspectives of solar system development by millilight spacecraft (SC) (fusion-powered space flight).** U. N. ZAKIROV, 40th IAF International Astronautical Congress, Malaga, Spain, Oct. 7-13, 1989. 6 pp. 6 Refs., (IAF Paper 89-279).

The perspectives and requirements for using spacecraft propelled by He-3 thermonuclear fuel in manned space missions are investigated. Among the perspectives considered are: manned missions to Mars (a 30-60 day flight) and to planets of Jupiter group (a 60-100 day flight); flights of the Sond probes to monitor Comet Halley and the sun, and finally flights to the nearest stars. The requirements include operating time, impulse, and meteoritic effects.

**A90-12661 Solar occultation spectroscopic measurements of the Martian atmosphere at 1.9 and 3.7 microns.** V. A. KRASNOPOL'SKII, V. I. MOROZ, A. A. KRYSKO, O. I. KORABLEV, V. S. ZHEGULEV et al., *Nature* (ISSN 0028-0836), Vol. 341, Oct. 19, 1989, pp. 603, 604. 7 Refs.

Solar occultation measurements taken from Phobos 2 of the H<sub>2</sub>O and CO<sub>2</sub> bands at 1.9 micron and of the dust absorption at 1.9 and 3.7 microns are presented. They are used to calculate vertical profiles of water vapor, dust, and atmospheric temperature in the 10-70 km range. The water vapor mixing ratio profile demonstrates oscillations from 10 to the -5th to 10 to the -3rd with a period of 25 km. This behavior is explained by the condensation and evaporation of water at minima and maxima of the temperature oscillations.

**A90-12666 Observation of electron and ion fluxes in the vicinity of Mars with the HARP spectrometer.** N. M. SHUTTE, A. V. DIACHKOV, P. KIRALY, T. E. CRAVENS, T. I. GOMBOSI et al., *Nature* (ISSN 0028-0836), Vol. 341, Oct. 19, 1989, pp. 614-616. 6 Refs.

Preliminary results are presented of electron and ion measurements in the vicinity of Mars with the hyperbolic analyzer in the retarding potential model (HARP). HARP is a differential electrostatic analyzer, simultaneously covering eight directions arranged in a fan-shaped geometry, in the antisolar hemisphere. The angular resolution is about 20 deg, the energy resolution about 10 percent. During the first two elliptical orbits, electrons from 3.4 to 550 eV and ions from 0.25 to 550 eV were measured in 25 and 50 logarithmic energy steps, respectively. The energy distribution of electrons in the magnetosheath was found to be generally characterized by two distinct peaks. A fairly hot electron component was discovered in the plasma sheet of the areomagnetic tail.

**A90-12658 Determination of the elemental composition of Martian rocks from Phobos 2.** IU. A. SURKOV, V. L. BARSUKOV, L. P. MOSKALEVA, V. P. KHARIUKOVA, S. E. ZAITSEVA et al., *Nature* (ISSN 0028-0836), Vol. 341, Oct. 19, 1989, pp. 595-598.

The elemental composition of Martian soil has been determined from Phobos 2 orbital gamma-ray spectrometry. The results lead to the conclusion that vast territories on the Martian surface are covered with aeolian deposition layer. The measurement process and techniques and the data processing scheme involved are described.

**A90-12657 Thermal imaging of the surface of Mars.** A. S. SELIVANOV, M. K. NARAEVA, A. S. PANFILOV, IU. M. GEKTI, V. D. KHARLAMOV et al., *Nature* (ISSN 0028-0836), Vol. 341, Oct. 19, 1989, pp. 593-595. 10 Refs.

Examples of thermal images obtained of the Martian surface by the Thermoscan experiment on the Phobos spacecraft are presented. The thermal images from the experiment provide far higher resolution than previous data collected by Vikings 1 and 2. They provide more comprehensive data on the temperature distribution and thermal inertia of the Martian surface and its relief elements, which make it possible to search for thermal anomalies.

**A90-12655 Spatial variations in thermal and albedo properties of the surface of Phobos.** L. V. KSAFOMALITII, V. I. MOROZ, J. P. BIBRING, A. SOUFFLOT, M. COMBES et al., *Nature* (ISSN 0028-0836), Vol. 341, Oct. 19, 1989, pp. 588-591. 9 Refs.

Analysis of Mariner 9, Viking 1 and 2, and ground-based experimental data has led to the conclusion that the surface layer of Phobos consists of fine-grained material with a composition close to that of carbonaceous chondrites. Observations of the mean Phobos diameter obtained by the Phobos 2 mission with a resolution of 1/20-1/40 are presented here which show, for the first time, inhomogeneities in the thermal and spectral properties of the surface of Phobos.

**A89-52815 Radiative transfer in the 4.3-micron CO<sub>2</sub> band in the atmospheres of Venus and Mars under vibrational and rotational non-LTE conditions (Perenos izlucheniia v polose CO<sub>2</sub> lambda 4.3 mkm v atmosferakh Veneri i Marsa pri narushenii kolebatel'nogo i vrashchatel'nogo LTR).** V. P. OGIBALOV and A. A. KUTEPOV, *Kinematika i Fizika Nebesnykh Tel* (ISSN 0233-7665), Vol. 5, July-Aug. 1989, pp. 27-37. 6 Refs.

A numerical solution to the problem of radiative transfer in the 4.3-micron CO<sub>2</sub> band is obtained for the plane model atmospheres of Venus and Mars. The introduction of the individual source functions for certain rotational-vibrational transitions (the wideband approximation) is shown to increase the local maxima in the diurnal and nocturnal vertical profiles of the vibrational temperature of the 00(0)1 state as compared to those presented by Stepanova and Shved (1985).

**A89-47888 The evolution of the meteoritic craters of Mars (Evolutsiia meteoritnykh kraterov Marsa).** M. S. KRASS, *Astronomicheskii Vestnik* (ISSN 0320-930X), Vol. 23, Apr.-June 1989, pp. 134-144. 10 Refs.

The problem of the relaxation of the depression at the surface of the viscous medium layer with T nonuniform with respect to depth is studied. It is shown that the dynamics of the disturbed permafrost of Mars leads to the presence of concave and convex sections of their surface and to points of inflection on the vertical profile.

**A89-47950 The initial prerequisites and considerations in the development of a piezo-electric transformer of an apparatus complex for seismological investigations on Mars (Iskhodnye predposylki i soobrazheniia pri razrabotke p'ezoelektricheskogo preobrazovatel'nogo kompleksa dlia seismologicheskikh issledovaniia na Marse).** GAROMARDIROSIAN and VIKTOR FREMD, *B'lgarsko Geofizichno Spisanie* (ISSN 0323-9918), Vol. 15, No. 2, 1989, pp. 108-114. 9 Refs.

The need for an apparatus complex with specific technological characteristics and high reliability to study the inner structure and tectonic forces on Mars via seismological methods is demonstrated. It is shown that the limitations of the space apparatus and problems with the seismological instruments depend on the receiver-transformer part of the complex. A three-component seismic receiver with a piezoelectric transformer is described.