

Russian and Japanese Aerospace Literature

Throughout 1992 the *AIAA Journal* will carry selected abstracts on leading research topics from Russian 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 Environments from Russia and Propulsion System Configurations/Designs from Japan.

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Russian Aerospace Literature This month: *Planetary Environments*

A91-49493 Inverse problem of in situ photometry of scattered solar radiation in a planetary atmosphere—Retrieval of atmospheric scattering characteristics—Mathematical formalism and numerical experiments (Obratnaia zadacha in situ fotometrii rasseianogo solnechnogo izlucheniia v planetnoi atmosfere—Vosstanovlenie kharakteristik atmosfernogo rasseianiia—Matematicheskii apparat i chislennye eksperimenty). E. A. USTINOV, *Kosmicheskie Issledovaniia* (ISSN 0023-4206), Vol. 29, May–June 1991, pp. 443–457. 18 Refs.

The present study considers an inverse problem of radiative transfer which makes it possible to interpret measurements of spatial and angular dependences of scattered solar radiation in an optically thick planetary atmosphere in terms of vertical profiles of parameters governing the radiative transfer in the atmosphere. These parameters are related to an extinction coefficient and coefficients of the expansion of the scattering phase function based on Legendre polynomials. The inverse problem under discussion involves numerical differencing of measured data against altitude and is therefore incorrect. To solve it, Turchin's statistical regularization method is used. Results of two numerical experiments are presented which model measurements and a retrieval procedure for atmospheric models with conservative and nonconservative scattering.

A91-40076 Asteroid surface materials (Veshchestvo poverkhnosti asteroidov). D. F. LUPISHKO and I. N. BEL'SKAIA, *Astronomicheskii Vestnik* (ISSN 0320-930X), Vol. 25, Jan.–Feb. 1991, pp. 5–26. 51 Refs.

The problem of asteroid surface materials is addressed. Initial observational data on the study of asteroid matter, mechanisms for the formation of absorption spectra, spectral features of main mineral phases, asteroid taxonomic classes, and their general mineralogical characteristics are studied. The nature of the matter of C, S, and M asteroids and of the asteroid 4 Vesta is considered.

A91-11451 Evolution of the atmospheres of the terrestrial planets (Evolutsiia atmosfer planet zemnoi gruppy). JOSEPH W. CHAMBERLAIN, Rice Univ., Houston, TX. *Astronomicheskii Vestnik* (ISSN 0320-930X), Vol. 24, July–Sept. 1990, pp. 179–194. 64 Refs.

It is pointed out that, even though the atmospheres of the earth, Venus, and Mars have distinctly different climates, it appears likely that all three planets were created under similar conditions; the planets are different only in terms of mass and incident solar radiation. This paper considers some of the difficulties in assessing the nature of the primordial climates and in extrapolating these climates to the present day. In particular, questions concerning clouds, water, and CO₂ on the earth and on Mars are addressed.

A91-28067 NH₄SH and cloud cover in the atmospheres of the giant planets (Gidrosul'fid ammoniia i oblachnost' v atmosferakh planet-gigantov). K. I. U. IBRAGIMOV and A. A. SOLODOVNIK, *Kinematika i Fizika Nebesnykh Tel* (ISSN 0233-7665), Vol. 7, Jan.–Feb. 1991, pp. 58–63. 16 Refs.

The probability of the formation of NH₄SH and (NH₄)₂S is examined on the basis of the Le Chatelier principle. It is shown that it is very doubtful if NH₄SH can be created in the atmospheres of the giant planets in quantities sufficient for cloud formation. Thus (NH₄)₂S is considered as a more likely candidate for cloud formation in the atmospheres of these planets, inasmuch as the conditions for its production there are more favorable.

A91-39142 The choice of shape for bodies with minimal aerodynamic heating during motion in the atmospheres of the solar system planets (O vybore formy tel s minimal'nym aerodinamicheskim nagrevom pri dvizhenii v atmosferakh planet solnechnoi sistemy). M. A. KORCHAGINA and N. N. PILIUGIN, *Kosmicheskie Issledovaniia* (ISSN 0023-4206), Vol. 29, Mar.–Apr. 1991, pp. 298–309. 20 Refs.

Expressions are developed for the convective and the radiant-heat fluxes and the coefficients of friction and the wave drag for axisymmetric and planar bodies moving in the atmospheres of solar-system planets. Values of total heat and drag for blunted cones moving in the atmospheres of the earth, Venus, Mars, and Jupiter are calculated, and the results are used to examine the problem of the choice of satellite shape for minimizing its aerodynamic heating.

A91-49492 Turbulent collectivization processes of new ions near Venus and Mars, and problems of numerical modeling of solar wind interaction with these planets. II—A two-fluid MHD model (Turbulentnye protsessy kolektivizatsii novykh ionov u Venery i Marsa i problemy chislennykh modelei vzaimodeistviia solnechnogo vetra s etimi planetami. II—Dvukhzhidkostnaia MGD-model'). T. K. BREUS, A. M. KRYMSKII, and V. IA. MITNITSKII, *Kosmicheskie Issledovaniia* (ISSN 0023-4206), Vol. 29, May–June 1991, pp. 432–442. 15 Refs.

A two-fluid MHD model with anomalous friction between ion species due to turbulence in the magnetosheath is proposed for the solar wind interaction with Venus and Mars. The method for calculations and their results for both planets are given. The results are compared with experimental data from the Pioneer-Venus and Phobos-2 spacecraft and also with the results of the one-fluid MHD mode, with mass loading. The results of the two-fluid MHD model are in better agreement with the experimental data than those obtained earlier.

A91-41308 The distribution of small particles in an opaque circumplanetary swarm (Prostranstvennoe raspredelenie melkikh chastits v neprozrachnom okoloplanetnom roe). R. I. KILADZE, *Abastumanskaia Astrofizicheskaiia Observatoriia, Biulleten'* (ISSN 0375-6644), No. 68, 1990, pp. 125-134.

An independent method is presented for studying the spatial distribution of small particles in an opaque circumplanetary swarm in which the free path of particles is greater than the characteristic dimensions of the system. Equations are presented for the collision probability in a unit of time for a particle a specified distance from the center; for the magnitudes of the full velocity and its radial component in the two-body problem; and for integral curves in phase space. Functions are derived for density changes in the swarm's outermost, middle, and inner (opaque) parts. The change in the density of an opaque circumplanetary swarm of particles changes with distance from the gravity center has a stepwise form.

A91-39141 The inverse problem of temperature sounding. III—Retrieval of vertical profile of the mixing ratio of a minor gas constituent (Obratnaia zadacha termicheskogo zondirovaniia. III—Vosstanovlenie vertikal'nogo profil'a otnosheniia smesi maloi gazovoi sostavliashchei). E. A. USTINOV, *Kosmicheskie Issledovaniia* (ISSN 0023-4206), Vol. 29, Mar.-Apr. 1991, pp. 289-297, 18 Refs.

Using the general formula developed by Ustinov (1990), an inverse problem is formulated for retrieving the vertical profile of a minor gas constituent from measurements of the outgoing thermal radiation in the absorption band of this constituent. An analytical expression for the main body of the corresponding linearized inverse problem is obtained. A numerical experiment is carried out demonstrating the efficiency of the inverse problem.

A91-37274 Rare gases on planets (Blagorodnye gazy na planetakh). IURII A. SHUKOLIUKOV, *Priroda* (ISSN 0032-874X), Feb. 1991, pp. 75-81.

Abundances of rare gases on different planets are considered and differences in their concentrations are analyzed. It is shown that there is a regularity in the fractionation coefficients of rare gases that can be characterized by two laws of rare-gas abundances on the terrestrial planets. They are formulated as following: (1) the logarithm of fractionation coefficient of two gases on a planet is inversely proportional to the atomic mass ratio of these gases; (2) the logarithm of the fractionation coefficient of any two rare gases on a planet is an exponential function of the inverse of its orbit radius. The major fractionation mechanism of rare gases is their adsorption on solid particles in the protoplanetary nebula. This finding can clarify differences in concentration ratios of rare gases, e.g., Xe-130/Ar-36 and Ar-36/Ne-20.

A91-37154 The modeling of stratiform clouds in the atmospheres of giant planets with allowance for the intersolubility of condensing components. I (Modelirovaniie sloistoobraznoi oblachnosti v atmosferakh planet-gigantov s uchetom vzaimorastvorimosti kondensiruiushchikhisia komponentov. I). M. V. BUIKOV, K. IU. IBRAGIMOV, G. A. KIRIENKO, and A. M. PIRNACH, *Kinematika i Fizika Nebesnykh Tel* (ISSN 0233-7665), Vol. 7, Mar.-Apr. 1991, pp. 3-10.

The mechanism of two-component cloud formation is studied with allowance for the intersolubility of components. Equations describing the condensation growth of NH₃-H₂O drops are derived. It is shown that the time needed to achieve the equilibrium concentration is less than a fraction of a second, a finding which attests to the need to account for intersolubility. A computation of the water-ammonia cloud for Jupiter is presented to illustrate the laws of mixed cloud formation.

A91-29595 A possible interpretation of bright features on the surface of Phobos. IU. SHKURATOV, N. OPANASENKO, A. BAZILEVSKII, B. ZHUKOV, M. KRESLAVSKII et al., (Colloquium on Phobos-Mars Mission, Paris, France, Oct. 23-27, 1989, Proceedings. A91-29558 11-91) *Planetary and Space Science* (ISSN 0032-0633), Vol. 39, Jan.-Feb. 1991, pp. 341-347, 26 Refs.

A mechanism is presented to explain the lateral variations in the relative abundance of higher albedo and lower albedo components of an optically heterogeneous, two-component regolith. Laboratory measurements are presented of two-component mixtures and lunar telescopic observations, which both illustrate a larger brightening at low phase angles than can be explained by the classical shadowing mechanism of the opposition surge. It is then demonstrated that this effect can be explained by the interference mechanism of the oppositions surge. Possible geologic explanations for the implied lateral variation in regolith optical properties on Phobos are discussed.

A91-23978 A roving vehicle for studying the surface of Phobos (PROP) (Podvizhnyi apparat dlia izucheniia poverkhnosti Fobosa /PROP/). A. L. KEMURDZHIAN, P. N. BRODIIKII, V. V. GROMOV, G. V. KOZLOV, V. I. KOMISSAROV et al., *Instrumentation and methods for space exploration* (A91-23962 08-19). Moscow, Izdatel'stvo Nauka, 1989, pp. 136-141.

The design and operation of the PROP roving vehicle for investigating the surface of Phobos are described. The vehicle is equipped with instruments for determining the soil element abundances; the magnetic field components on the surface of Phobos; the magnetic permeability; the soil surface temperatures; and the physical and mechanical properties of the soil.

A91-28066 Characteristics of the relative spectral reflectivity and altitude differences of Jupiter's cloud belts (Osobennosti otositel'noi spektral'noi otrazhatel'noi sposobnosti i razlichiiia vysot oblachnykh poliasov Iupitera). V. G. TEIFEL' and G. A. KHARITONOVA, *Kinematika i Fizika Nebesnykh Tel* (ISSN 0233-7665), Vol. 7, Jan.-Feb. 1991, pp. 49-57, 14 Refs.

An analysis of longitudinal variations of the relative spectrophotometric gradients using spectrograms of Jupiter's central meridian is presented. It is shown that in the dark SEB and NEB belts the gradient at 0.40-0.50 micron is significantly smaller than at 0.50-0.68 micron, in contrast to the bright equatorial and tropical zones and polar regions. It is suggested that these effects can be explained as due to differences in cloud top altitudes: the effective cloud boundary in the dark belts is approximately 15-20 km lower than in bright cloud zones.

A91-25190 Peculiarities of the motion of white spots in the southern temperate band and in the Red Spot of Jupiter (Osobennosti dvizheniia belykh platen iuzhnoi umerennoi polosy i Krasnogo pliatna Iupitera). V. A. ZINOV'EV, *Astronomicheskii Vestnik* (ISSN 0320-930X), Vol. 24, Oct.-Dec. 1990, pp. 337-341.

Three stages of the drift-velocity variation of three white spots observed in the Jupiter STB with the 30-cm Zeiss refractor at Volgograd during 1964-1986 are described. The main observed tendency is the deceleration of the drift. Periodic irregularities in the motion were observed which differ for each white spot. The longitudinal distribution of the motion peculiarities exhibits a main maximum to the east of the Red Spot as well as some secondary maxima. The time variations of these peculiarities are correlated with the relative dimensions of the Red Spot and with solar activity (i.e., the appearance of recurrent sunspot groups).

A91-23982 Combined radiometer-photometer (KRFM) and infrared spectrometer (ISM) for investigating Mars and Phobos (Kombinirovannyi radiometr-fotometr /KRFM/ i infrakrasnyi spektrometr /ISM/ dlia issledovaniia Marsa i Fobosa). L. V. KANFOMALITI, V. I. MOROZ, J. P. BIBRING, and A. SOUFFLOT, *Instrumentation and methods for space exploration* (A91-23962 08-19). Moscow, Izdatel'stvo Nauka, 1989, pp. 161-170.

The KRFM-ISM experiment was designed to investigate the physical properties and mineralogical composition of Mars and Phobos. The design, characteristics, and operation of the instruments are described in detail, and the observation program is briefly discussed.

A91-23977 Determination of the element composition of the rocks of Phobos and Mars using the GS-14 STsF gamma-ray spectrometer (Operdeleniie elementnogo sostava porod Fobosa i Marsa s pomoshch'iu gamma-spektrometra GS-14 STsF). IU. A. SURKOV, L. P. MOSKALEVA, A. G. MITIUGOV, S. E. ZAITSEVA, O. P. SOBORNOV et al., *Instrumentation and methods for space exploration* (A91-23962 08-19). Moscow, Izdatel'stvo Nauka, 1989, pp. 129-135.

The design and technical characteristics of a gamma-ray spectrometer for measuring the element composition of Phobos and Mars rocks are presented. The experimental design is described, and a cyclogram of the operation of the gamma-ray spectrometer is presented.

A91-23976 Investigation of the composition of Phobos rocks using X-ray radiometric instrumentation (Issledovanie sostava porod Fobosa s pomoshch'iu rentgenoradiometricheskoi apparatury). IU. A. SURKOV, F. F. KIRNOZOV, V. N. GLAZOV, A. G. DUNCHENKO, L. P. TATSII et al., *Instrumentation and methods for space exploration* (A91-23962 08-19). Moscow, Izdatel'stvo Nauka, 1989, pp. 125-129.

An X-ray radiometric instrument designed to analyze the elemental abundances of Phobos rocks is described. A rock sample is subjected to radiation from an radioisotope source, and the excited fluorescent X-rays from the chemical elements present in the sample is recorded via an X-ray spectrometer. The main technical characteristics of this instrumentation are described.

A91-23612 Geochemistry of the Venera 8 material demonstrates the presence of continental crust on Venus. O. V. NIKOLAEVA, *Earth, Moon, and Planets* (ISSN 0167-9295), Vol. 50-51, July-Dec. 1990, pp. 329-341, 33 Refs.

The possible terrestrial chemical counterparts of the materials at the Venera 8 and Venera 13 landing sites are restudied on the basis of the most recent terrestrial geochemical data and in anticipation of Magellan data on the Venera geologic-tectonic settings. Results indicate that the primitive mafic composition of the Venera 13 material is quite dissimilar to the inferred evolved intermediate composition of the Venera 8 material, suggesting the existence of a continental crust on Venus.

A90-48307 Soft landing dynamics of spherical landing modules (Dinamika miagkoi posadki spuskaiemykh apparatov sfericheskoi formy). V. G. PERMINOV, *Kosmicheskie Issledovaniia* (ISSN 0023-4206), Vol. 28, July-Aug. 1990, pp. 539-544.

A method is described for analyzing the soft landing dynamics of spherical landing modules in the case where the landing velocity has a component parallel to the landing surface. Changes in the motion parameters of a spacecraft with time and in relation to the surface inclination are examined as an example. The approach proposed here can be used for both spherical landing modules and modules whose front surface is part of a sphere.

A91-23964 Dion—An experiment involving the remote analysis of the Phobos surface (Dion—Eksperiment po distantsionnomu analizu poverkhnosti Fobosa). R. Z. SAGDEEV, W. RIEDLER, M. AMLIN, C. BEGHIN, M. BUJOR et al., *Instrumentation and methods for space exploration* (A91-23962 08-19), Moscow, Izdatel'stvo Nauka, 1989, pp. 14-21. 5 Refs.

The goal of the Dion experiment is to measure the elemental composition of the Phobos surface using secondary ion mass spectrometry. The measurement process is outlined. Scientific questions to be addressed by data gathered in this experiment include the determination of the composition of the Phobos regolith, the measurement of the isotopic composition of Phobos, and the investigation of the topographic composition of the Phobos surface. Detailed descriptions and schematic drawings are provided of both the SIPPI instrument and the analytical portion of the quadrupole-mass-spectrometer Fortron.

A91-23617 Ridge belts—Are they compressional or extensional structures? V. P. KRIUCHKOV, *Earth, Moon, and Planets* (ISSN 0167-9295), Vol. 50-51, July-Dec. 1990, pp. 471-491. 38 Refs.

The controversy concerning the origin of the ridge belts found to exist on the plains of Venus in the radar survey of Venera-12 and Venera-16 is discussed. A review is presented of evidence which supports the theory of ridge formation due to extension and compression observed within the ridge belts. The major speculative ideas and models of the ridge belt origin are discussed. The argument in support of ridge formation by extension suggests that these linear features are results of crust cracking and the intruding of magma along these cracks. It is proposed that the ridge of belts can be analogies of the orogenic belts and subduction zones on earth. It is noted that the question of the ridge belts' origin remains controversial. Future indicators to be collected which may provide more certain geological interpretations of the ridge belt formation are listed.

A91-23601 Vital problems of Venus geology—Outlook for their resolution by Magellan and post-Magellan missions. ALEKSANDR T. BAZILEVSKII, *Earth, Moon, and Planets* (ISSN 0167-9295), Vol. 50-51, July-Dec. 1990, pp. 3-23. 49 Refs.

Five areas of study considered to be vital for progress in Venus geology are detailed, and their relevance to Magellan and post-Magellan missions is discussed. These issues include the study of the general style of endogenetic activity of Venus; the major geochemical types of crust material on Venus; the character and intensity of exogenic processes; and the structure of Venus' interior and its seismicity. It is established that the first two areas of inquiry will enjoy decisive advances from Magellan data. It is suggested that, while the third and fourth areas of study will benefit from data obtained through the Magellan mission, the establishment of a program of post-Magellan missions would provide additional vital information.

A91-20192 Chemical and isotopic compositions of the atmospheres of the giant planets (Review) (Khimicheskii i izotopnyi sostav atmosfer planet-gigantov /Obzor). V. A. DOROFEEVA and S. P. BORUNOV, *Geokhimiia* (ISSN 0016-7525), Sept. 1990, pp. 1219-1231. 95 Refs.

Data available on the chemical and isotopic compositions of the upper atmospheres of Jupiter, Saturn, Uranus, and Neptune are used to obtain ranges of variations and of the most probable abundance values of a number of elements and isotopic ratios in the atmospheres of these planets. On the basis of a comparison of these values with data on cosmic abundances and with thermodynamic calculations, a plausible mechanism is proposed for the formation and the subsequent evolution of these planets, together with the possible composition of the gas phase in the area of giant-planet formation.

A91-17131 Modeling of planetary regolith (Modelirovanie planetarnogo regolita). O. D. RODE, O. I. IAKOVLEV, and A. T. BAZILEVSKII, *Geokhimiia* (ISSN 0016-7525), Aug. 1990, pp. 1210-1214. 11 Refs.

The dynamics of planetary-regolith formation following a collision with a meteorite is investigated by analyzing the nature of breakdown products of a natural target after a single impact by a duraluminum or a copper ball, and by examining secondary processes accompanying the impact. Using the experimental setup described by Barvin and Cherniavskii (1979) for producing a single-impact scenario, breakdown products were analyzed chemically and morphologically. It was found that, in the case of a basaltic target, a single impact by a high-speed heavy impactor led to a complete breakdown of the target and to its fractionation according to its mineral and chemical composition, followed by the agglutination of the fractionation products. It is suggested that several regolith-forming processes initiated by the impact lead to a formation of all the basic components of the regolith, the surface of which is later modified by the solar wind and galactic cosmic rays.

A90-12658 Determination of the elemental composition of Martian rocks from Phobos 2. I. 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.

A91-11918 Characteristics of the impact differentiation of the silicate and ore components of the primordial crust (Osobennosti udarnoi differentsatsii silikatnogo i rudnogo veshchestva protokory). V. I. REKHARSKII, I. P. DIKOV, L. M. MUKHIN, and M. V. GERASIMOV, *Akademiia Nauk SSSR, Doklady* (ISSN 0002-3264), Vol. 313, No. 5, 1990, pp. 1219-1223. 7 Refs.

Results of an experimental study of the differentiation of the silicate minerals and rocks, characteristic of hypothetical protoplanets, under the effect of a laser pulse are reported. The targets used in the study included basalts, pyroxenites, peridotites, and chondrites as well as pyroxenes, amphiboles, orthites, and eudialyte. An analysis of the results obtained suggests that the nucleation and evolution of silicate and silicate-fluid systems and mobilization and concentration of ore elements occurred in the process of the formation of a petrochemically and geomechanically heterogeneous crust at the earliest (accretion) stage of earth evolution.

A90-41968 Inverse problem of thermal sounding—Retrieval of the vertical profile of the absorption coefficient of the optically active component of a planetary atmosphere from observations of outgoing thermal (Obratnaia zadacha termicheskogo zondirovaniia—Vosstanovlenie vertikal'nogo profilia koeffitsienta pogloshcheniia opticheskii aktivnoi sostavliaiushchei planetnoi atmosfery po nabliudeniim ukhodiashchego teplovogo izlucheniia). E. A. USTINOV, *Kosmicheskie Issledovaniia* (ISSN 0023-4206), Vol. 28, May-June 1990, pp. 402-412. 7 Refs.

An expression for the kernel of the linearized inverse thermal-sounding problem for a planetary atmosphere is obtained by means of two methods: direct variations of the expression, for the intensity of the outgoing thermal radiation and the use of solutions of the direct and conjugate problems of thermal radiation transfer. The results obtained can be used to retrieve the vertical profile of the extinction coefficient of purely absorbing aerosol and the gaseous-component mixture ratio.

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.

A90-34276 The universe and the origin of life—Origin of organics on clays. V. I. MARON and M. D. NUSSINOV, *British Interplanetary Society Journal* (ISSN 0007-084X), Vol. 43, Jan. 1990, pp. 3-10. 62 Refs.

The similarity of the self-organization processes of matter, which occurred at the chemical stage of evolution in space, to the biological processes on the earth's surface makes it possible to develop a scenario of the earliest beginning of the noncellular physicochemical phase of biological evolution during the period about 4×10 to the 9th years ago. The products of chemical reactions which occurred in space as complicated organic compounds, the bricks of life, such as bases of nucleic acids and amino acids reached the 'juvenile' earth mainly in meteoroids and subsequently took part in building up the first viruslike nucleoproteinaceous biological structures. Thus, the essential link was accomplished between the chemical and the biological stages of the evolution of matter. The nucleotide hypothesis as the origin of live matter includes the possible formation, during a transient period, of symbiotic material systems composed probably of the RNA molecule of polynucleotide and the molecule of polypeptide, both synthesized abiogenetically in situ within a clayish 'liposome', which served as the basis for a nucleoproteinaceous complex (protovirus) origination.

A89-37376 Scientific objectives of the Mars Rover/Sample Return mission (Nauchnye zadachi proekta 'Marsokhod/Vozvrat obraztsov porod'). M. H. CARR, *Astronomicheskii Vestnik* (ISSN 0320-930X), Vol. 23, Jan.-Mar. 1989, pp. 3-13. 12 Refs.

The prospective Mars Rover/Sample Return mission is designed to better understand the origin and evolution of Mars, to search for evidence of former life, and to improve knowledge of the Martian environment in preparation for subsequent human exploration. Mars is of particular interest because it formed in a different part of the solar system from the earth, has experienced a wide range of geologic and meteorological processes, is the only planet other than earth where life is likely to have started, and will be the first among the planets to be explored by humans. The rover provides a means of exploring the planet on a human scale and of performing a wide range of in situ measurements at different locations.

A89-35023 The planet next door. ALEKSANDR T. BAZILEVSKII, *Sky and Telescope* (ISSN 0037-6604), Vol. 77, April 1989, pp. 360-366, 368.

The geological characteristics of Venus are discussed, based on results from the Pioneer and Venera 15 and 16 missions. The geochemical features and possible age of the Venusian plains are examined. In addition, consideration is given to the geochemical and geophysical nature of the mountainous, volcanic, and tectonic zones of Venus. Plans for the Magellan probe to Venus are reviewed.

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.

A90-21815 Heat transfer by a meridional circulation cell and the static stability of the atmosphere on a slowly rotating planet (Perenos tepla meridional'noi tsirkulatsionnoi iacheikoi i staticheskaia ustoychivost' atmosfery na medlenno vrashchayushcheisia planeta). S. S. ZILITINKEVICH, *Kosmicheskie Issledovaniia* (ISSN 0023-4206), Vol. 27, Nov.–Dec. 1989, pp. 932–942. 22 Refs.

Equations are derived for determining the equator-pole temperature contrast and the static-stability parameter in a planetary atmosphere in which the main heat-transfer mechanism is ordered meridional circulation. The results obtained are used to estimate the atmosphere heat-adaptation periods, the wind-velocity scales, and other circulation characteristics on Venus.

A90-12655 Spatial variations in thermal and albedo properties of the surface of Phobos. L. V. KSNFOMALITII, 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.

A89-42522 Spreading on Venus (Spreding na Venere). ALEKSEI L. SUKHANOV, ALEKSEI A. PRONIN, *Priroda* (ISSN 0032-874X), May 1989, pp. 27–37.

With reference to Venus imagery obtained by Venera 15 and 16 orbital stations and other observations, it is argued that the Venus range belts are analogs of the spreading phenomenon on the earth, an important element in plate tectonics. The discussion covers the structure of the valleys, problems involved in the interpretation of Venus surface imagery, the range belt relief and patterns, volcanoes in the range belts, and the breakdown of the range belts. Evidence is presented in support of the conclusion that the Venus range belts represent zones of tension rather than compression.

A89-36513 Ridged belts on Venus as extensional features. A. L. SUKHANOV and A. A. PRONIN, *Proceedings of the 19th Lunar and Planetary Science Conference*, Houston, TX, Mar. 14–18, 1988, (A89-36486 15-91). Cambridge/Houston, TX, Cambridge University Press/Lunar and Planetary Institute, 1989, pp. 335–348. 28 Refs.

Some characteristics of ridged belts on Venus are difficult to explain by compressional folding. Occurrences of massive linear swells with partly collapsed roofs, volcanoes and ring structures, unusual relationships at belt intersections and terminations, the position of some belts in large valleys, and their symmetrical or rhombical patterns, all suggest the belts could be constructed of linear intrusions, dikes and extrusions emplaced as a result of regional extension. The fan-like system of belts located within the northern hemisphere from 150–250 deg appears to have been produced by the formation and spreading of new crust that has divided the older highlands, possibly as part of the spreading system that includes Aphrodite Terra. The mechanism of Venusian spreading seems to be different from that of the earth as it produced multiple low-amplitude ridged belts instead of midoceanic ridges with orthogonal transform faults.

A90-21808 A method for constructing the limit region of admissible initial positions of a spacecraft during its descent from orbit into a planetary atmosphere (Metod postroeniia predel'noi oblasti dopustimykh nachal'nykh polozhenii apparata pri ego spuske s orbity v atmosfere planet). G. A. VINOGRADOVA and S. A. VOEVODIN, *Kosmicheskie Issledovaniia* (ISSN 0023-4206), Vol. 27, Nov.–Dec. 1989, pp. 867–876.

The paper examines the problem of searching for a region limited by the set of initial points of optimal descent trajectories in a planetary atmosphere, from which it is possible to bring the vehicle to a given landing site either under nominal flight conditions or in the presence of disturbing factors. A general method for constructing this region is proposed, and a calculation example involving quasi-optimal control is presented.

A89-54651 Computer-aided identification and analysis of lineaments on the basis of radar images of Venus (Avtomatizirovannoe vydelenie i analiz lineamentov po radiolokatsionnym izobrazheniiam Venery). A. IA. DANIL'CHENKO, M. S. MARKOV, M. V. OSTROVSKII, and IU. S. TIUFLIN, *Geodeziia i Kartografiia* (ISSN 0016-7126), July 1989, pp. 23–26. 6 Refs.

An algorithm is developed for the computer-aided identification and analysis of lineaments on radar images. The algorithm was implemented in the VENERA program, and used for the computer-aided processing and analysis of radar images of the Venus surface obtained with the Venera 15 and 16 probes. Lineament maps were then constructed.

A89-42539 Stratified rocks of Venusian plains in the light of Venera 15 and 16 data (Sloistye porody venerianskikh ravnin v svete dannykh 'Venera-15, -16'). O. V. NIKOLAEVA, *Geokhimiia* (ISSN 0016-7525), April 1989, pp. 478–485. 31 Refs.

The lithological characteristics of the extremely low-strength stratified rocks found on Venus at the landing sites of Venera 9, 10, 13, and 14 are examined in the light of the new geological data obtained by Venera 15 and 16. Based on these data, these rocks are interpreted as deposits of volcanic basalt ash. If this is the case, the observable properties of the stratified rocks indicate that basalt ashes on Venus were produced by eruptions of the Hawaiian and Strombolian types associated with small domes. The chemical erosion of basalt ashes on Venus involves the formation of surface films on glass particles.

A89-38822 On the surface composition of the M-type asteroids. D. F. LUPISHKO, and I. N. BEL'SKAIA, *Icarus* (ISSN 0019-1035), Vol. 78, April 1989, pp. 395–401. 21 Refs.

Photometric and polarimetric observations of the largest M-type asteroids conducted over the period 1978–1986 are presently interpreted in view of results from laboratory photometric and polarimetric measurements of meteoritic, terrestrial silicate, and metallic samples. The samples, including among its 13 meteorites suitable representatives of iron, chondrite, and achondrite types, are of similar structure, with grain sizes smaller than 50 microns. An analysis of all data extant indicate that the surfaces of the largest M-type asteroids, namely 16, 21, 22, 69, and 110, cannot consist of pure metal; they must instead include silicate component-like stony-iron and enstatite chondrite meteorites.

A89-35550 The relief of the crust-mantle boundary and strain-compression stresses in the crust of Venus (O rel'efe granitsy kora-mantlia i napriazheniakh rastiazheniia-szhatia v kore Venery). K. I. MARCHENKOV and V. N. ZHARKOV, *Pis'ma v Astronomicheskii Zhurnal* (ISSN 0320-0108), Vol. 15, Feb. 1989, pp. 182–190. 15 Refs.

A joint analysis of the topography and nonequilibrium part of the gravitational field of the Venus was carried out for spherical harmonics with $n=3-18$. The characteristics of the crust-mantle boundary and of the strain-compression stresses in the crust were revealed for a series of realistic models of Venus with allowance for the asthenosphere. In general, the crust-mantle boundary of Venus is sufficiently smooth. The stresses vary from +600 bars (strain) to -700bars (compression) as a function of the model of the planet's interior.

Japanese Aerospace Literature

This month: Propulsion System Configurations/Designs

A91-13768 The design and orbital operation of Space Flyer Unit. K. KURIKI, N. NINOMIYA, M. NAGATOMO, N. TSUYA, M. KAWACHI et al., IAF, 41st International Astronautical Congress, Dresden, Federal Republic of Germany, Oct. 6–12, 1990. 12 pp. (IAF Paper 90-055).

The Space Flyer Unit (SFU) is an unmanned, reusable multipurpose platform to be launched by the Japanese H-II rocket and retrieved by the U.S. Space Shuttle. The SFU core system and payloads are described, and the SFU target mission and performance are summarized. SFU operation is examined, including the launch phase, early orbit phase, mission operation phase, preretrieval phase, retrieval phase, proximity operation phase, and return phase.

A90-24950 'HYREFS series codes' users' manual. K. VISWANATH REDDY and TOSHI FUJIWARA, *Nagoya University, Faculty of Engineering Memoirs* (ISSN 0027-7657), Vol. 41, No. 1, 1989, pp. 39–92. 14 Refs.

The basic theoretical principles and application procedures of HYREFS, a set of computer programs for the numerical simulation of hypersonic reacting flows, are presented in a manual for potential users. The formulations of the governing equations and the solution algorithm are outlined; the FORTRAN 77 numerical implementation is explained; and the subroutine code structures and input-output procedures are examined in detail. Graphs, flow charts, tables of numerical data, and sample HYREFS graphics are included.