THE THERMAL RADIATION OF THE LUNAR SURFACE IN THE IR RANGE OF THE SPECTRUM (10-12 μm).

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The emission of the lunar surface in the visual and infrared spectral ranges is stable and constant in space and time and can easily be described analytically. This allows one to reduce the measured brightness and temperature values to any geometry of the angular parameters of observation and illumination.

The digital models of the fields of the radiation temperature and photometric brightness of the Moon are based on physical regularities and statistical relationship between the intensity of thermal and reflected radiation, the geometry of observation and illumination, and the albedo and microrelief of the lunar surface.

The temperature phase function is described by am empirical formula that corresponds to the mean statistical model of the lunar thermal field. The general form of the equation for the phase function of radiation temperature is

$$T = T_o(1- 0.5*\Delta a/a)[k_1 \cos i + k_2 \cos i \sin (|G| - C_1) + k_3 \cos(|G| + C_2) + 262],$$

where T_o is the radiation temperature in the subsolar point in K; G is the phase angle in degrees; a is the astronomical unit equal to 149.6 million kilometers; k_1, k_2, and k_3 are the coefficients in the empirical equation of regression for the dependence of temperature on the angular parameters; and C_1 and C_2 are constant coefficients equal to 18 and 34, respectively, for the maria surface. For highlands, C_1 = 10 and C_2 = 50.

The space indicatrix of the Moon's thermal emission was constructed by results of the statistical processing of the database 1655 lunar sites in the vector form (fig.1, 2, 3). The software package constructs the thermal and the visual image of the Moon on the computer screen for a given phase, and calculates the brightness and temperature of any area of the lunar surface with an angular resolution of 8"-10".

The technique of calibrating scan images using the Moon's image was successfully used for the radiometric calibration of the onboard apparatus of the first Russian geostationary meteorological satellite (GOMS) launched on October 31, 1994, in accordance with the program "Meteorological Service for the Population". The infrared channel records thermal fluxes from objects with radiation temperatures between 213 and 313 K. The accuracy of the calibration of the measured temperature is comparable with the accuracy of the determination of the fundamental lunar constants, which are used in digital models of the thermal emission of the lunar surface. The root-mean-square error in the determination of the radiation temperature is ±1.5 K. An infrared images of the Moon, obtained from the GOMS artificial satellite, are presented in Fig. 4, 5, 6.

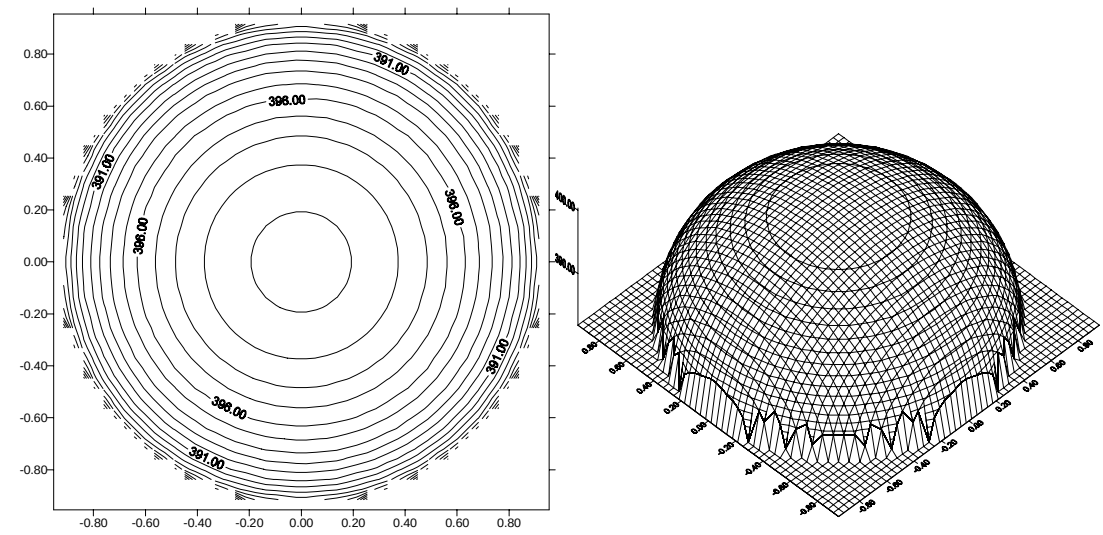

Fig.1

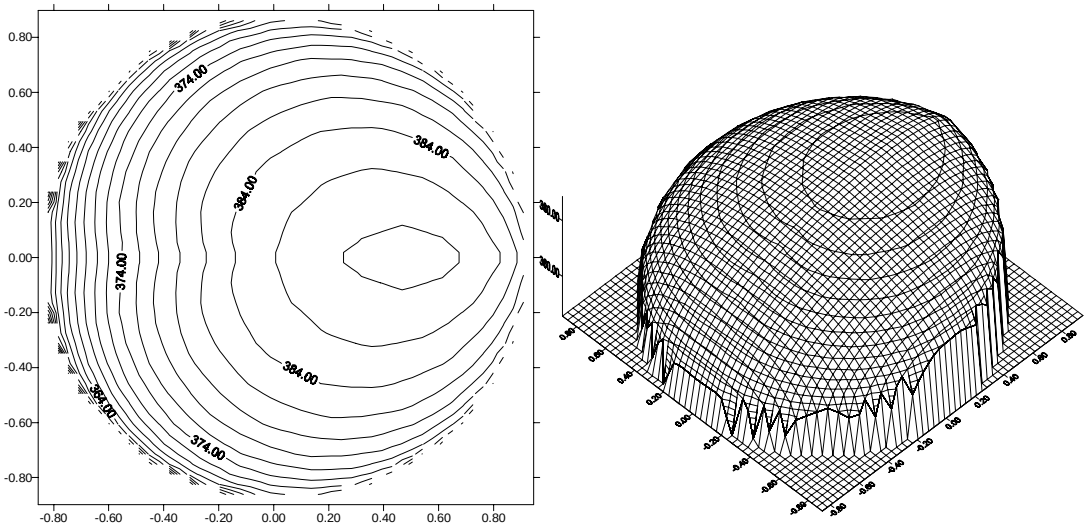

Fig.2

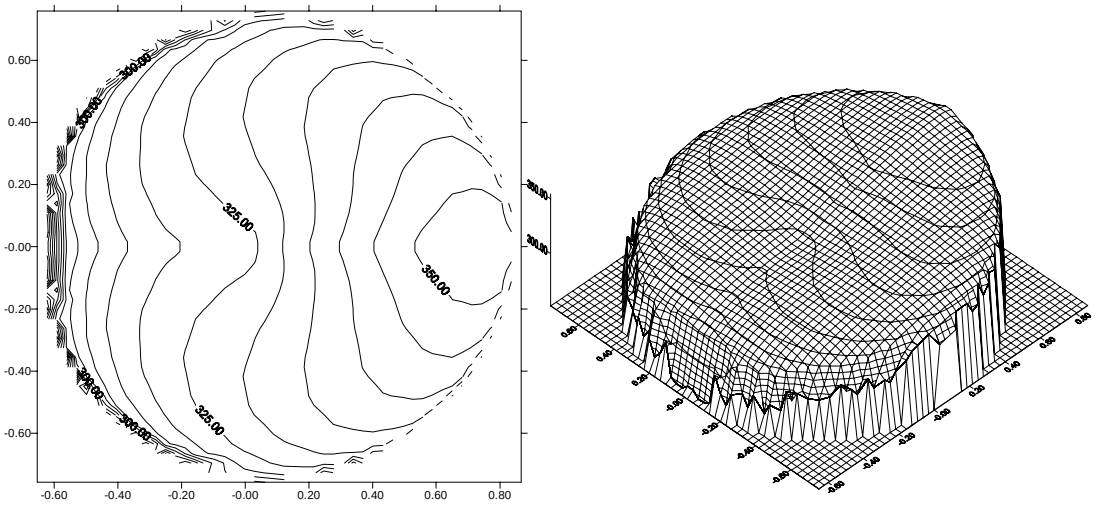

Fig.3

Indicatrix of the thermal radiation of the Moon (10.5-12.5 μ). The angles of the solar-light incidence (*i*) are 0^o (fig.1), 30^o (fig.2), 60^o (fig.3).

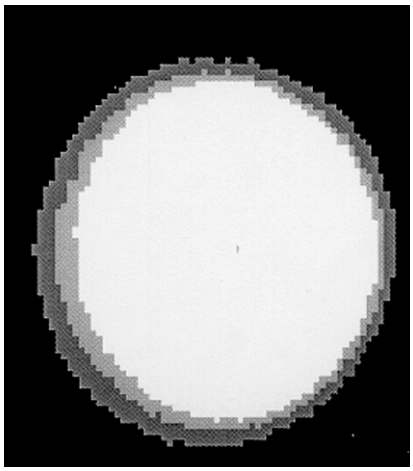

Fig.4. Cosmic image of the lunar surface in the IR range (10.5-12.5 μm) obtained on March 15, 1995, at the Moon's phase angle of -26.5^{o}.

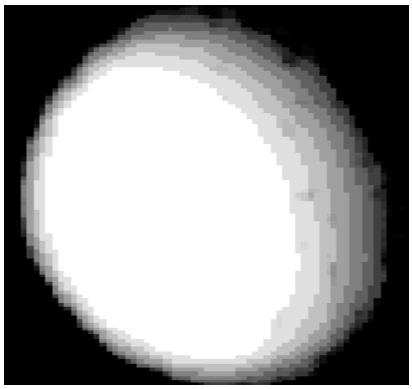

Fig.5. Cosmic image of the lunar surface in the IR range (10.5-12.5 μm) obtained on July 15, 1995, at the Moon's phase angle of +35.4^{o}.

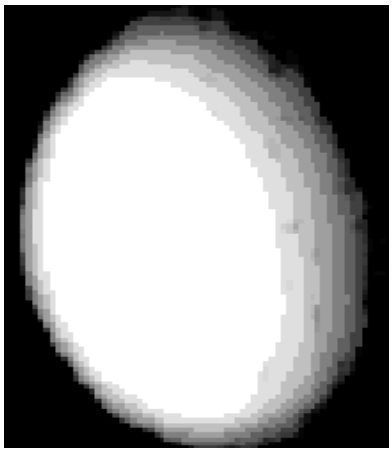

Fig.6. Cosmic image of the lunar surface in the IR range (10.5-12.5 μm) obtained on January 9, 1996, at Moon's phase angle of +34.4^{o}.