A NEW DATA SET FOR THE ABSOLUTE SOLAR ENERGY DISTRIBUTION IN THE 310-1070 NM WAVELENGTH REGION

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We briefly report on the results of the absolute spectral measurements of solar radiation at the high-mountain station on Peak Terskol, the Caucasus, in 1989 and 1992, including the integral spectrum of the solar disc center, the entire disc, and the brightness temperature of the solar continuum. The fitting of the absolute spectral distribution data for the Sun and Vega with UBV multicolor photometry data is discussed. The results of the solar and stellar spectrophotometry show that the UBV color indices of the Sun must be close to the normal values of the G2V star.

1. Introduction. The absolute energy distribution of the solar disc center at wavelengths of 310-685 nm was measured at the high-mountain station of the Main Astronomical Observatory of the Ukrainian National Academy of Sciences on Peak Terskol near Elbrus in 1989 [1]. In 1992, the program was extended to long wavelengths of up to 1070 nm. The result was a unified set of data on the integral spectrum of the solar disc center over a wide range of wavelengths, including the near IR region with \( \lambda > 870 \) nm for which the complete spectral data were previously inaccessible. Using those data for absolute calibration of a high-resolution solar spectrum written in relative units, we also localized the absolute position of the solar quasicontinuum. Furthermore, using average data on the limb darkening in the integral spectrum, we found the spectrum distribution of the entire solar disc and the spectral irradiance at a distance of 1 A.U.

To date, there are several independent sets of measurements of the solar spectrum composition in absolute energy units. The most popular among them are the data proposed by Neckel and Labs [9], which serve as a basis for almost all fundamental constructions of modern solar physics. Our measurements show that the data of Neckel and Labs are underestimated by 6-8% in the near IR region and are overestimated by 2-3 in the UV and visible regions. We argue that the dependence of the position of the solar continuum on the wavelength is more gradual and is free of the singularities in the IR region which were mentioned by Neckel and Labs. These singularities can be explained by the errors of local integrals in [9] due to incomplete account of the absorption of solar radiation in the Earth atmosphere.

2. For observations we used a specialized spectrophotometric complex described in [1]. The complex included a horizontal solar telescope, an automated diffractional spectrophotometer, a system for display, control, and transmission of spectral irradiance units, an aureole photometer, and auxiliaries for study and optical control of the measurement schemes. The measurement technique consisted in the comparison of the radiation spectrum of the solar disc center with the spectrum of the laboratory source. We used the same optical scheme in all measurements to avoid the optical selectivity of the telescope and the spectrometer. The measurements were reduced to zero air mass far away from strong telluric lines and bands (the UV and visible regions) by Bouguer method supplemented by independent control of the optical stability of the atmosphere. The results of the semiempiric calculation of the Earth atmospheric absorption spectrum were employed additionally at the same wavelengths where telluric lines cause the Forbes’ effect (the IR region) due to the limited spectral resolution of the spectrometer. Such calculations were performed for 16100

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3. The main results reported in this paper are based on the data related to the spectral irradiance (SI) of the solar disc center measured in 1989 and 1992 and presented in the form of 1 nm-averaged integrals. A comparison with the data proposed by Neckel and Labs is given in Fig. 1. (The table will appear in "Kinematika i Fizika Nebesnykh Tel.") The estimated error in the SI of the solar disc center amounts to 2.5% for $\lambda = 310$ nm, 2.2% for $\lambda = 400$ nm, and does not exceed 2% for the longer wavelengths. The oxygen and water vapor lines, using a standard atmosphere model corrected by the weather parameters measured in the observations.