component II was enhanced while components II and III became much more steady than normal. On another occasion the mode change lasted for about 1,300 pulses. In this case the pulse energies were weak so that detailed information could not be obtained. The phenomenon has been observed at 430 MHz with circular polarization. Mode changes lasting for five to ten pulses have also been detected.

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Molecular Oxygen Absorption of Solar Lyman-α observed by Interkosmos-I

The satellite Interkosmos-1, a joint project of the Soviet Union, the German Democratic Republic and Czechoslovakia, was launched on October 14, 1969, into an orbit with perigee height 260 km, apogee height 640 km and an inclination of 48·4 degrees. A Lyman-α photometer, designed at this institute, was mounted on the observing platform of the satellite, and directed towards the Sun with an accuracy of ± 1 degree. The photometer consisted of a modified ionization chamber of Forsterite ceramics with an LiF window and a filling of NO gas[1], followed by a d.c. amplifier with a time constant of 0·14 s and two output channels with different sensitivities. The spectral range of the photometer was from 1050 Å to 1350 Å[2]. Its absolute calibration, carried out at the Physical Institute of the Academy of Sciences of the USSR, yielded a scale value of $K_{\text{phot}} = 0{\cdot}780 \times 10^{11}$ photons $cm^{-2}\,s^{-1}\,V^{-1}$ at 1216 Å in the high-sensitivity channel, with an error of ± 3 per cent. During the period of observation, October 15–23, 1969, the measured absolute values of solar Lyman-α flux varied between 3·7 and 4·7 ergs $cm^{-2}\,s^{-1}$, with a mean value of 4·1 ergs $cm^{-2}\,s^{-1}$. One purpose of the experiment was to measure the height-dependent absorption of Lyman-α in the upper atmosphere when the satellite entered the Earth's shadow ("satellite sunset"). The most reliable data of this kind were obtained on October 15 at 1409 UT, when the line-of-sight between the satellite and the Sun touched the Earth's surface at a geographic latitude of about 40° N. For this case, Lyman-α absorption, expressed in terms of optical thickness of the atmosphere as a function of the "grazing height" above the Earth's surface, is presented in Fig. 1. The orientation of the satellite towards the Sun was guaranteed for all grazing heights greater than 10 km.

Theoretical curves of optical thickness at grazing incidence were calculated from the O_2 and N_2 densities given by the CIRA 1965 model atmosphere, which are nearly equal to the mean values between the summer and winter models of the US Standard Atmosphere Supplement 1966. Absorption cross-sections of $\sigma(O_2) = 8{\cdot}4 \times 10^{-21}$ cm^2 for O_2, and $\sigma(N_2) = 6 \times 10^{-23}$ cm^2 for N_2 (ref. 3) were adopted. With these cross-sections, absorption by N_2 contributes less than 3 per cent to the total optical thickness below 120 km. This theoretical height dependence of optical thickness, taking into account the finite diameter of the Sun's disk, is represented by the

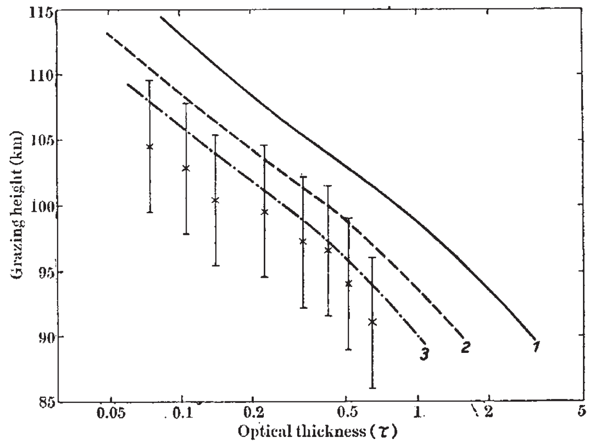

Fig. 1. Optical thickness at grazing incidence for Lyman-α, measured on the satellite (crosses). Theoretical values of optical thickness are computed from the CIRA 1965 model atmosphere (curve 1), and with O_2 densities reduced to a half and a third of the CIRA values (curves 2 and 3, respectively).

continuous curve in Fig. 1. It coincides almost exactly with similar calculations by Thomas and Bowman[4]. Fig. 1 shows that the measured data have nearly the same height gradient as the theoretical curve, but their absolute values are smaller than the theoretical ones by a factor of three or more.

Because it seems improbable that the cross-sections adopted are wrong by a factor of this order of magnitude, we have to conclude that at least in the height interval between 90 and 120 km the O_2 concentration should be only one third of the CIRA model values in order to fit the observed absorption. (The broken curves indicate theoretical optical thickness if the O_2 concentration is reduced to half or one third of the CIRA values, respectively.) This conclusion agrees well with recent rocket absorption measurements around 1450 Å made by Wildman *et al.*[5] in Australia, and with a similar difference between CIRA data and rocket ultraviolet absorption results reported by Weeks and Smith[6]. Mass spectrometer data[7] also indicate that at around 150 km the CIRA O_2 concentrations are considerably too large, whereas the analysis of Solrad-8 Lyman-α absorption by Norton and Warneck[8] seemed to agree with the CIRA model. It must be remembered, however, that the calculation of grazing heights for satellites is difficult and may introduce systematic errors. In the case of our measurements, the grazing heights were determined from simultaneous intensity records of visible sunlight on the satellite, and the estimated height error should not exceed ± 5 km, as indicated by error bars in Fig. 1. The observed difference, therefore, between the O_2 concentration of the CIRA 1965 model and our data seems to be significant.

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