Redetermination of Monochromatic Absorption Coefficients' Values of Ammonia in visible Range of the Spectrum for Atmospheres of Jupiter and Saturn

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Özet As it is known the main gas constituents of Jupiter's and Saturn's atmospheres are hydrogen (0,86 and 0,83 correspondingly) and helium (0,13 and 0,16), and insignificant degree of methane (∼ 0,07 %) and ammonia (∼ 0.01 %). In comparison with absorption band of methane in the spectra of Jupiter the absorption band of ammonia possess considerably smaller intensity, which is still well-defined enough. At Saturn ammonia bands are definable on a detection limit. In spite of the fact that in Jupiter's atmosphere ammonia's content is insignificant quantity, but it plays about the same role as water vapor plays in Earth's atmosphere, and for certain, not to a lesser degree in the atmosphere of Saturn. Optical parameters of planets' atmospheres are determined from the analysis of the observed data (i.e., by research brightness distribution over the disks of planets in a continuous spectrum, and also molecular absorption bands) within the limits of those or other representations about vertical structure of atmosphere. Therefore, the analysis even the same observed data, under various assumptions of vertical structure of a cloud layer, leads to various values of determined parameters. For systematic research of that point it was necessary to systematize in more details available data and to consider a number of important factors as temperature dependence of absorption coefficients of molecular gases, the account of aerosol scattering, more exact determination of relative concentration of gases and an effective optical thickness etc. For this purpose it is necessary to know exact values of monochromatic coefficients of absorption of gases $k\nu$ under corresponding conditions, i.e. in the conditions of atmospheres of planets. For Jupiter and Saturn, first of all, it concerns methane and ammonia at equilibrium temperatures. Unfortunately, the true data of k which are available for methane, is not present now for ammonia even in laboratory conditions (discrepancies of $k\nu$ are about 10 % in the centers of absorption bands and several times differ near to a continuous spectrum) [1]. The goal of the present work is determination of monochromatic coefficients from ammonia's absorption bands in visible range spectra of Jupiter and Saturn in the thermal

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conditions of atmospheres of these planets by observed and laboratory spectral data for these bands. The essence of the method of determination of monochromatic coefficient of absorption kν in the conditions of atmosphere of planets can be described shortly as follows. As the form of the graphic dependence of ln (Nl/τs) from ln (Nl) (here, Nl - quantity of gas in the sight beam mamagat, and τs - the scattering component of effective optical depth τeff formed by the radiation diffuse-reflected from a homogeneous semi-infinite layer, which values are determined by data albedo of single scattering in a molecular absorption band ?? and in a continuous spectrum ωc) does not depend on the form of scattering indicatrix [2], we can plot graphs by the contours of gas absorption band for observed spectra of a planet and for laboratory measurements on the same gas absorption band. For a given wavelength set of the laboratory spectra NH3 corresponding values of ln (Nl) andβ ν (where,) have being selected. Then ln (Nl/τs) is calculating from the same dependence plotted for observed spectra of a planet. Therefore β ν/kν are calculated for a planet and then are determined in the atmosphere conditions of the planet. Thus, values of for the specified absorption bands in the thermal conditions of the planets have been determined from the laboratory spectra and measurements of monochromatic absorption coefficients of for bands NH3λ 6475 $\mathring{A}$ and λ 5520 $\mathring{A}$ at a room temperature, and also on observable spectra of Jupiter and Saturn. Recalculation of values k? in a thermal mode for atmospheres of Jupiter and Saturn was conducted by a "fitting" of the laboratory data of the planetary atmosphere. At first, for values kν, of course, the laboratory data [3] were adopted. Results of the calculation show that in the conditions of atmospheres of Jupiter and Saturn in far wings of the absorption band NH3λ 6475 $\mathring{A}$ the values of kν are comparable with laboratory measurements, but in the central region of this band the deviation increases even to $\sim$ 2.8 times. Values of the calculated integral absorption coefficient for Jupiter in 1,65 and 2,1 times differ from laboratory values for bandsλ 5520 $\mathring{A}$ and λ 6475$\mathring{A}$, correspondingly. Values of the calculated integral absorption coefficient for the band NH3 λ 6475 $\mathring{A}$ in the conditions of Saturn differ from laboratory values at 1.65 times. In comparison with Jupiter temperature goes down in Saturn, owing to pressure of saturated steams sharply decreases. It can be connected with the fact that a part of ammoniac gas on Saturn has been condensed, forming a crystal cover of the planet and by that shields an internal cloud layer of the planet responsible for effective gas absorption.