

The molecular absorption bands behavior on Jupiter before and at the Southern Equatorial Belt disappearance.

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1. Introduction

The disappearance of dark Southern Equatorial Belt (SEB) in 2010 is not exclusive but very rare event on Jupiter. Preceding cases of the SEB disappearance or very low contrast took place in 1989 and yet no less 8 times during the last century : in 1952, 1949, 1943, 1940-1941, 1936-1937, 1927-1928, 1926 according [1,2]. In 1904 the NEB disappeared, if the orientation of two pictures for that time in [1] is right. It is evident that these changes are connected with more or less intensive vertical atmospheric circulation at low latitudes. Now we have an opportunity to search probable changes in the cloud structure from the study of the molecular absorption bands measurements on Jupiter's disk and to compare them for SEB and NEB during "usual" and "unusual" state of the SEB region.

2. Observations

Spectral observations of Jupiter on the observatory of Fessenkov Astrophysical Institute are fulfilling regularly during each season of this planet visibility [3]. There were 14 observational nights in June-October 2009 and 18 nights in July-December 2010. For these observations 24-inch telescope and diffraction spectrograph SGS with CCD-camera ST-7XE were used. The spectra of central meridian of Jupiter have been recorded as well as special scanning of Jupiter's disk was done by consequent records of zonal spectra at the slit oriented in parallel to Jovian equator. In general more than 7800 spectrograms have been obtained and their processing is continued. But some conclusions may be done from preliminary analysis of the processing results. The analysis includes a number of the methane absorption bands in the range 580-900 nm and separately the ammonia band centered at 787 nm. This band was measured from the Jupiter and Saturn spectra ratio to exclude methane absorption in this range. The spectra of Ganymede were recorded

also to exclude the telluric H₂O absorption influence in the CH₄ band 725 nm.

3. Data processing

The profiles of the absorption bands were plotted and the equivalent widths and central depths of bands were calculated for all points of Jovian central meridian or for separate belts at low and temperate latitudes. Main view was directed on the comparison of the data for SEB and NEB in 2009 and 2010 to find probable and noticeable distinctions. Figures 1-2 illustrate S-N variations of the methane absorption for moderate bands CH₄ 619 and 725 nm. There are some small latitudinal differences which show an increase of absorption in 725 nm within SEB and NEB although these differences are no more +/-3-5 per cent as well as for all temperate and low latitudes.

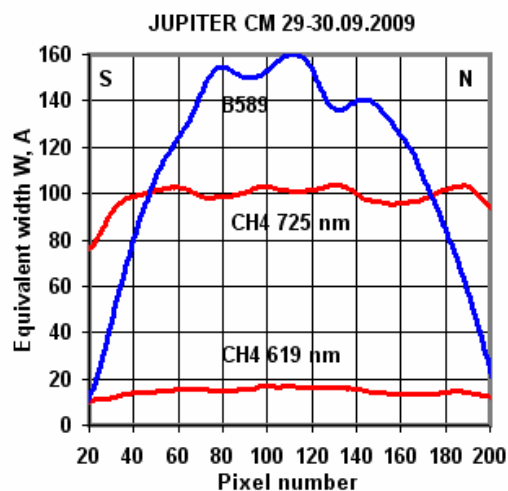


Figure 1 - Variations of the CH₄ 725 and 619 nm absorption bands equivalent widths in 2009 at "normal" state of SEB..

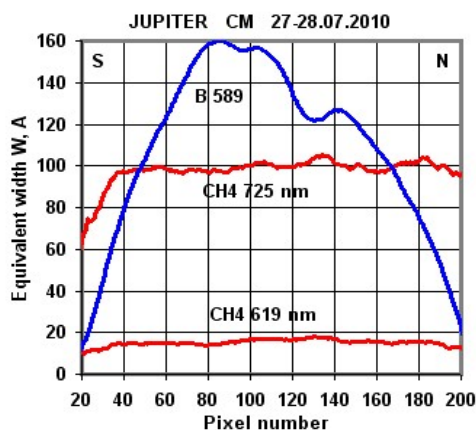


Figure.2 – Variations of the CH₄ 725 and 619 nm absorption bands equivalent widths in 2010 at “disappeared” SEB.

The variations of the CH₄ 619 nm band are more and reach about 10 per cent. This band is formed significantly deeper in the cloud layers and its behavior is more irregular on Jupiter’s disk.

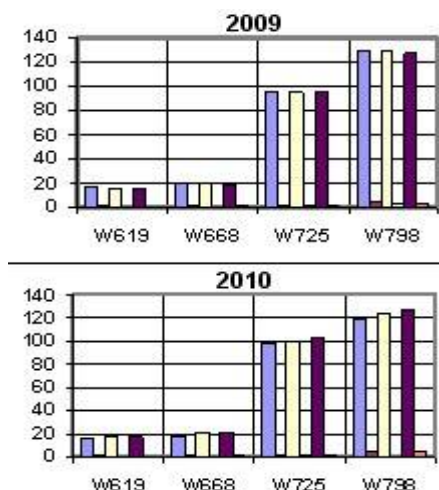


Figure 3 – Equivalent widths of the CH₄ bands in SEB (left columns), EZ and NEB in 2009 and 2010.

All data of 2010 observations show the absence of clearly expressed anomalies in SEB which may be visible in the molecular absorption.

The ammonia absorption in the band 787 nm in 2010 is keeping the depression in Northern hemisphere as in preceding years [4] and do not show anomalies in SEB. The decrease of the NH₃

absorption was detected also in the Great Red Spot region

4. Discussion

As may be seen from described results the disappearance of dark matter in the SEB region in 2010 did not accompanied by noticeable and principle changes of the methane and ammonia absorptions. Some thin effects, of course, could be detected at higher space and spectral resolution but there are no significant differences from 2009 or preceding years. However, it is not mean the full absence of the changes in the clouds within SEB. There was no the decrease of the CH₄ 890 nm absorption band in SEB and it is especially important that the IR observations [5] discovered low intensity of 4.8 mkm radiation in SEB in contrast to NEB which looks as bright belt. Probably it is connected with increased volume density of cloud layer in SEB. It is less probably that upper cloud boundary in SEB lies higher because we see there well expressed absorption in the strong 890 nm band.

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