COMPARATIVE STUDY OF THE MOLECULAR ABSORPTION BANDS BEHAVIOR ON JUPITER BEFORE AND AT THE SOUTHERN EQUATORIAL BELT DISAPPEARANCE. V. G. Tejfel, V. D. Vdovichenko, N. N. Bondarenko, A. M. Karimov, G. A. Kharitonova, G. A. Kirienko, N. V. Sinyaeva, Fessenkov Astrophysical Institute, Alma-Ata, Kazakhstan, tejf@hotmail.com

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.

The 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 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 metane absorption in this range. The spectra of Ganymede vere recorded also to exclude the telluric H_2O absorption influence in the CH_4 band 725 nm.

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 the meridianal variations of the methane absorption for moderate bands CH_4 619 and 725 nm. There are some small latitudinal differences which show an icrease 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. 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.

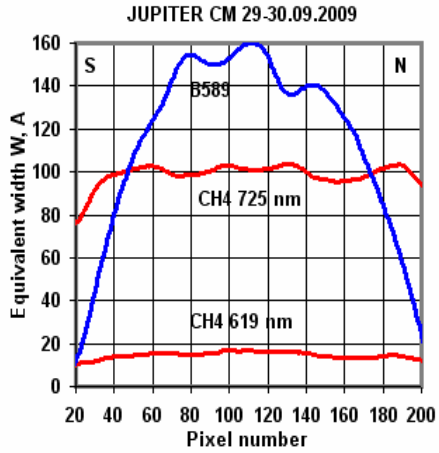

Fig.1 – Variations of the CH_4 725 and 619 nm absorption bands equivalent widhs in 2009 at "normal" state of SEB.

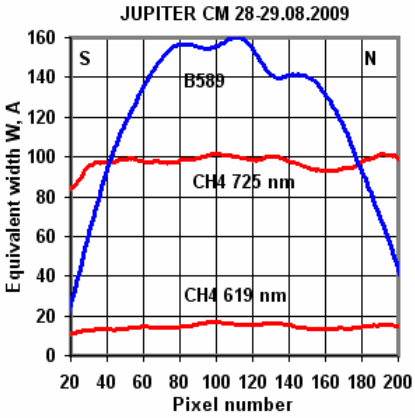

Fig.2 – Variations of the CH_4 725 and 619 nm absorption bands equivalent widhs in 2009 at "disappeared" SEB.

These latitudinal variations may be illustrated some better by the ratio of the intensities in continuum and in the absorption band center normalized to equatorial zone (EZ) intensity (Figures 3-6).

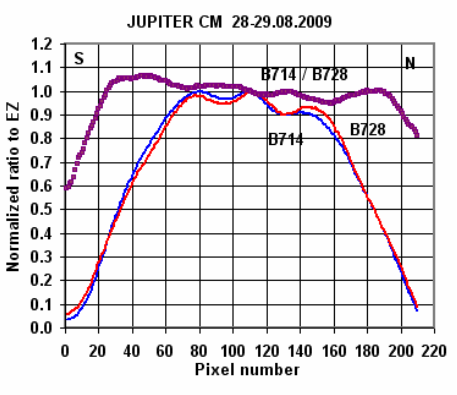

Fig.3 – The ratio of the intensities in continuum (714 nm) and in the CH_4 band center (728 nm) normalized to EZ in 2009.

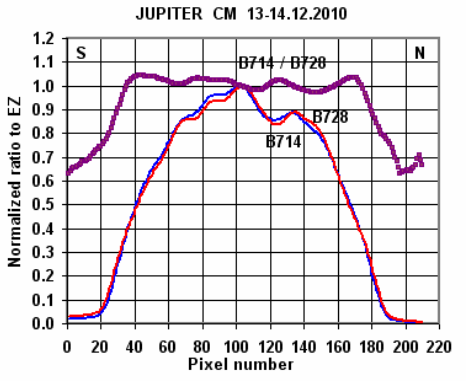

Fig.4 - The same as on Figure 3 but for 2010.

All data of 2010 observations show the absence of clearly expressed anomalies in SEB which may be visible in the molecular absorption. The band CH_4 890 nm is seemed even stronger in SEB than in NEB as seen from Figures 5 and 6 and from the comparison of their spectral profiles.

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 NH_3 absorption was detected also in the Great Red Spot region

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.

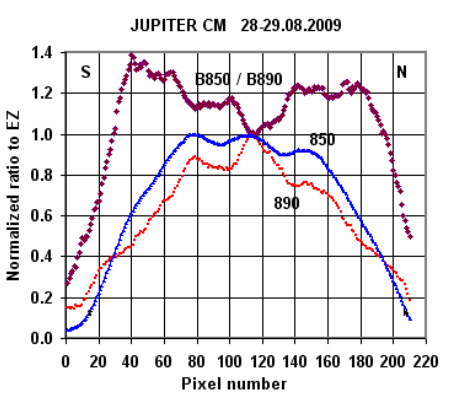

Fig.5 - The ratio of the intensities in continuum (850 nm) and in the CH_4 band center (890 nm) normalized to EZ in 2009.

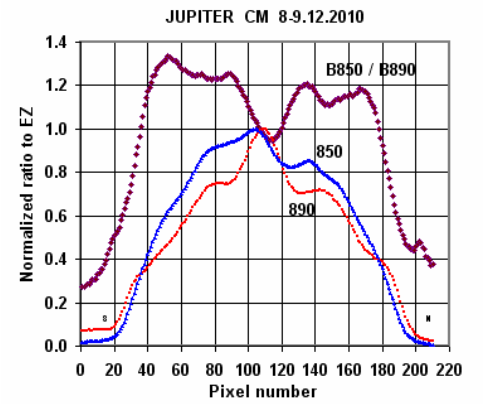

Fig.6 - The same as on Figure 5 but for 2010.

Some increase of the CH4 890 nm absorption band in SEB is observed 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 and even increased absorption in the strong 890 nm band.

References: [1] Slipher E.(1964) A photographic study of brightest planets, Lowell Obs. [2] Peek B.M.(1958) The planet Jupiter. F&F,London.[3] Tejfel V.G., et al..(2005) Astron.& Astroph. Transactions, v.24,359-363. [4] Tejfel V.G., Karimov A.M., Vdovichenko V.D. (2005). Bulletin Amer.Astron.Soc., , v.37, No.3 Abstr.#30-29. [5] Orton G.(2010) Private comm..