APPEARANCE SECOND HARMONIC IN THE JUPITER SPECTRUM.

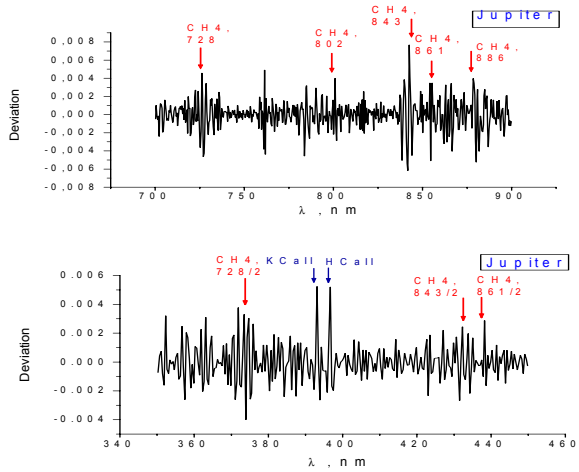
N.M.Kostogryz[1], A.P.Vidmachenko[2],
[1]Kyiv National Taras Shevchenko University, Kyiv, Lomonosova str.,55, kostogryz@univ.kiev.ua
[2]Main Astronomical Observatory NASU, vida@mao.kiev.ua

Nonlinear atmospheric optics (NAO) combines phenomena, where intensity light depends on optical parameters of medium. The investigations of atmospheric characteristics began to spread after the first Lidar investigations in the Earth's atmosphere. They showed that the row of interesting effects appeared when the powerful laser radiation went through Earth's atmosphere. The basic of them leaded to making new scientist direction – nonlinear optics of Earth's atmosphere. NAO has such effects:

1. Increase and decrease absorption in Earth's atmosphere when powerful laser's radiations go through the atmosphere.
2. Appearance combination frequencies on the line ray.
3. Appearance on the line ray divisible frequencies.

These effects can appear when the intensity is not so strong too. For our investigations, we used the spectral observations received by E.Karkoshka in 1993 and 1995 on the ESO from 300 to 1000 nm [1,2]. When we register vibration-rotation line in wide molecular bands (for example the band of methane CH_4 in the giant planets' spectrum), then we'll receive spectra of vibration-radiation transit between breaking up energetic levels which are different for every next moment. That's why when we observe very narrow, crossing and often don't resolve spectral line of chemical elements, then receive some registrograms of spectra and do average of them, we'll have to observe increasing of deviation for every separate measuring from its average value. The reason is obtaining of atmospheric spectrums, which are form on the different heights with different physical characteristics of atmosphere. And so far as the atmosphere is very dynamic formation with multicomponent chemical composition and multicompound molecules then rotation and vibration levels are very changing in time. So it's very difficult to receive the band with resolved separate lines. Sometimes when we receive some dozens of registrograms of spectra with signal-to-noise ratio more than 100, do average and for every spectrum calculate deviation from average. For that part of spectrum with molecular lines (even don't resolve), we'll have to observe significant increasing of root-mean-square deviation. If the atmosphere is irradiated by strong source of electromagnetic waves (for example the Sun), there may be appearance nonlinear effects of electromagnetic radiation interaction with matter of planets atmosphere. One of these effects is a generation of second harmonic. It is quite good elaborate for interaction of highly coherent laser's radiation with some crystals. Such method is possible to use for giant-planets' atmospheres, which are irradiated by the Sunlight.

When we examine the ratio of intensities for 1995 to 1993 we saw some deviation from average on the basic and double frequencies. This fact can show existence the second harmonic. The main task of our job was finding the second harmonic in the strong absorption line of methane in the spectrum of Jupiter. The theoretical basic of appearance the second harmonic is in [3]. We can see the deviation from average for Jupiter on the basic and double frequencies on the fig .1. There you can see some place with appearance second harmonic. We find existence double harmonic in the strong absorption lines of methane in the Jupiter's spectrum, when we worked up observation data with our program. This effect account must be taken of determine optical parameters of gas-aerosol and chemical composition of planet's atmosphere.



Reference:
1. Erich Karkoshka. Spectrophotometry of Jovian Planets and Titan at 300- to 1000-nm Wavelength: The Methane Spectrum / *Icarus*. 1994. - V.111, No 1. P. 174 – 192.
2. Erich Karkoschka. Methane, Ammonia, and Temperature Measurements of the Jovian Planets and Titan from CCD – Spectrophotometry / *Icarus*. – 1998. V.133, No1. P.134 – 146.
3.Vid'machenko A.P., Kuznetsova J.G., Krushevskaya V.N. Nonlinear optical effects in planetary atmospheres // *Kinematics and Phys. of Celestial Bodies.* -2003. - V.19, Supplement No 4. P.108-112.