

**ALTITUDE AND LATITUDE DISTRIBUTION OF ATMOSPHERIC AEROSOL AND WATER VAPOR FROM THE NARROW-BAND LUNAR ECLIPSES PHOTOMETRY.** O. S. Ugolnikov<sup>1</sup>, I. A. Maslov<sup>1,2</sup>. <sup>1</sup>Space Research Institute, Russian Academy of Sciences, Profsoyuznaya st., 84/32, Moscow, 117997, Russia, ougolnikov@gmail.com. <sup>2</sup>Sternberg Astronomical Institute, Moscow State University, Russia

Total lunar eclipses give the opportunity to hold the ground-based observations with the geometry analogous to the space limb measurements. The role of spacecraft is played by the Moon entered into the umbra and illuminated by the solar emission refracted, scattered and absorbed in the Earth's atmosphere. Lunar surface photometry in narrow spectral bands compared with results of numerical simulation for the gaseous atmosphere allows to detect the additional absorption which can be related with atmospheric aerosol or trace gas above the different locations along the limb of the Earth. Since the refraction angle depends on the ray perigee altitude, we can measure the absorption in different layers of the troposphere and lower stratosphere [1].

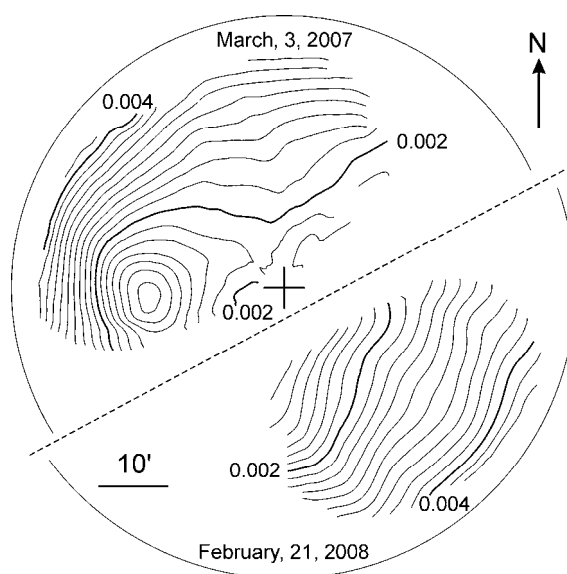
The work is based on the photometric surface measurements of four total lunar eclipses in 2004, 2007, and 2008 conducted at Southern Laboratory of Sternberg Astronomical Institute (Crimea). The main measured value is the umbra darkening factor equal to the ratio of lunar surface point inside and outside the umbra.

The measurements in narrow spectral region outside the atmospheric gases absorption bands (as 8670 Å for 2007 and 2008 eclipses) show the map of aerosol absorption.

The optical properties of the umbra are always found to be anisotropic. For the most part of cases the equatorial part of umbra is sufficiently darker. The separated dark spot in the equatorial part of the umbra was observed during the March, 3, 2007 eclipse (see the figure). Numerical analysis shows the relation of this effect with tropical aerosol at the altitudes about 10 km [2]. But there are some cases of polar dark spots of the umbra as it was observed during the recent eclipse of February, 21, 2008.

The regions and values of aerosol absorption along the limb are compared with the data of polar stratospheric clouds, stratospheric aerosol and large cyclones in the atmosphere.

During the eclipse of March, 3, 2007, the photometry was held also in the H<sub>2</sub>O absorption spectral region, in the band with effective wavelength 9380 Å. The map of H<sub>2</sub>O absorption at the altitudes 10 and 15 km was compared with the SCIAMACHY space experiment [3] data for the same date. This comparison shows the data agreement and allows to estimate the scale of water vapor vertical distribution in the atmosphere (1.3 km).



**Figure.** The distribution of optical darkening inside the umbra for two lunar eclipses in 2007 and 2008 for the wavelength 8670 Å.

- References** [1] Ugolnikov O.S., Maslov I.A. (2006) *Journal of Quantitative Spectroscopy and Radiative Transfer* 102, 499-512. [2] Ugolnikov O.S., Maslov I.A. (2008) *Journal of Quantitative Spectroscopy and Radiative Transfer* 109, 378-388. [3] Noël S., Buchwitz M., Burrows J.P. (2004) *Atmosphere Chemistry and Physics* 4, 111-125.