METEOROID IMPACTS DETECTION FROM AN ORBITER AROUND THE AIRLESS COSMIC BODY. Kosarev I.B., Nemtchinov I.V. Institute for Dynamics of Geospheres, Leninsky pr. 38, bld 6, Moscow, 117979, Russia, kosarev@idgl.chph.ras.ru

Large and small particles of the meteoroid stream may reach the surface of the Moon or another airless cosmic body (Mercury, asteroids, comets). During impacts the kinetic energy of meteoroids is transformed into the kinetic and internal energy of the meteoroid vapor and vapor of the substance of the target's surface. Partially this energy is emitted as the radiation pulse. The efficiency of the initial kinetic energy transformation into radiation for the airless body is much smaller then in the case of meteoroid's impact onto the Earth's atmosphere. Nevertheless, estimates and numerical simulations have shown that this efficiency is sufficient for detection impacts onto the lunar surface even from the Earth [1,2]. At the peak of the Leonid's storm of 1999 (November 18) approximately 38% of the lunar disk as seen from the Earth was not illuminated by sunlight and the flashes might be seen through telescopes. North American amateur astronomers do recorded at least six Leonid meteors on the Moon [3,4]. The conversion coefficient increases with the velocity of the impactor and reaches about 10^{-3}-$2\cdot10^{-3}$ for the Leonid's stream velocity of 72 km/s [5,6]. Taking into account the value of luminous efficiency the radii of meteoroid particles producing flashes were estimated as 2 cm to 10 cm [5,6].

Using distribution of particles in the Leonid stream by sizes and energy of detected light flashes the empirical value of luminous efficiency was obtained in [7] and it marvellously coincides with the theoretical value [3,4]. We note that the radiation efficiency depends only slightly on the impactor size, so the energy of the light flash is proportional to the cube of the radius of the meteors.

Rather large distance from the Earth to the Moon allowed to detect only light flashes created by rather large particles. The cumulative number of particles rapidly increase with the decrease of the particle size r: i.e. $N \sim r^{-\alpha}$ where α varies for different meteor streams, and even within the stream with the size, i.e. α = 1.8-2.6 for Leonids [7,8] and α = 3.5 for sporadic meteors [9].

To detect smaller impactors we need to use more sensitive instruments or simply decrease the distance from the detector to the cosmic body. Using the same detecting techniques or the same energy of the radiation impulse at the aperture of the sensor we may decrease the distance from the impact point to the detector in ω times and respectively

decrease the energy of the source in ω^2 times or the meteoroid size in $\omega^{2/3}$ times. For instance, if instead of observation of impacts on the Moon from the Earth, or at the distance of 300,000 km we shall observe the impacts from the lunar orbiter, i.e. at the distance of 3000 km, we may detect the impacts of meteoroid with the size about 20 times smaller than those which have been detected from the Earth. That means that the number of detected impactor will increase in several orders of magnitude. So all the dark size of the Moon will be covered by numerous flashes which can be detected from the Lunar orbiter. These flashes can be used for spectral analysis of the vapor radiation. One can use sophisticated spectral instruments for such analysis, but as the first approximation one can use simple filters cutting out several rather wide intervals of wavelengths which can be used for comparative analysis of the abundances of the chemical components of the vapor which molecules emit in various molecular bands.

Advantages of meteor streams for remote sensing is the known velocity and direction. Disadvantage is rather short interval of time at which high rate of impacts occurs. But sporadic meteors may also be used if the size of the planetary body, i.e. asteroid, to be investigated is not very small and the distance of the orbiter from the surface is not very large. According to the cumulative flux given in Melosh (1981) for a 1-mm in size meteoroids the rate of impacts onto a 100-km in radius body is once in 2 s. This seems to be sufficient for comparative study of different regions of the asteroid if the time of observation is rather long.

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