LUMINESCENCE OF COMETARY SUBSTANCE. I. Simonia [1] and A. Gucsik [2,] ,[1] The School of Natural Sciences and Engineering, Ilia State University, Cholokashvili str., 3/5, Tbilisi, 0162, Georgia, iraklisimonia@yahoo.com,

[2] Hungarian Academy of Sciences, Budapest, Hungary, argu1986@hotmail.com.

Introduction: It is proposed that under the action of solar, X-ray and UV photons and of the fluxes of charged particles of the solar wind, the cometary and other small bodies mineral substance are display various luminescence phenomena. The conditions under which this luminescence intensity can be compared in intensity with the scattered solar radiation are discussed. The mechanisms of luminescence processes and the methods of its identification in the cometary spectra are considered. It is suggested that the small bodies of the Solar System may be sources of a red luminescence similar to the red luminescence of interstellar dust, presumably related to the presence of organic matter. Other plausible materials and in particular minerals such as silicates, may also be identified from their luminescence spectra.

Photo- and Cathodoluminescence of Cometary Substance: The photoluminescence of comets can be of fluorescence or phosphorescence character depending on the chemical-mineralogical composition of its surface and halo material**.** It is known that under low temperature conditions, complex organic molecules such as PAHs can display a bright photoluminescence with a high quantum yield within 50-90% [1]. The importance of studying the photoluminescence of cometary substance is thus obvious. The photoluminescence may provide reliable information on the chemical and mineralogical composition, temperature, and some peculiarities of crystal lattice (point defects) of cometary materials including mineral substance. The photoluminescence spectra of cometary substance will vary in intensity, band positions and shapes depending on the characteristic properties of the specific materials of their surfaces and halo. The detection of photoluminescence from ground-based telescopes will depend (i) on the quantum yield of the photoluminescence of the material of the given comet and (ii) on the albedo of the cometary substance. The minimum, but sufficient condition for detection of the photoluminescence of the comets will depend on a combination between a high quantum yield of the photoluminescence (ℓ) of the material and an as low as possible albedo (A) of the latter. Numerically this can be expressed as $\ell \geq 50\%$, $A \leq 0.2$**.**The proposed values may be deduced from careful laboratory experiments, mainly based on simulations reproducing the physical characteristics of cometary substance (composition, temperatures and average irradiation in space). The temperature of the material of the comets will have a significant importance as under low temperature conditions, the quantum yield of photoluminescence of many substances increases significantly [2]. It is necessary to take into account the fact that, in contrast to the conditions of laboratory experiments, the natural cosmic material is subjected to the influence of the whole range of the solar shortwave electromagnetic radiation spectrum. This, in turn, can favor a high intensity of photoluminescence of cometary substance.In many cases, photoluminescence intensity may not be weaker than the scattered solar radiation, but can dominate over the latter [3]. Taking into account the definite similarity between meteorites and certain comets it seems reasonable to carry out a series of laboratory experiments for comprehensive studies of photoluminescence of meteorites and, in particular, of carbonaceous chondrites in context of cometary substance luminescence problem. This will allow to collect a reliable database for comparative analysis (e.g., micro-and nano-minerals from nature and experiment, [4].

Results: In this work the processes of photoluminescence and cathodoluminescence of comets and other small bodies of the solar system are discussed. It is suggested that the intensity of the luminescence could be comparable with the scattered solar radiation, and in some cases, could exceed it. Duration and other characteristics of the luminescence of the cometary substance are estimated. The concept of identification of luminescence emissions in the spectra of small bodies are proposed. However, one must point out that the application of our suggestion to a positive detection of luminescence phenomena from comets require to perform a careful set of laboratory experiments. The most relevant solids to be investigated are meteorites of various types but other synthetic materials such as amorphous carbon as well as organic molecules may be also considered. Experiments must provide not only good and interpretable spectra but must also address the efficiency of the processes invoked so as to be able to quantify the respective intensity of the luminescence to the scattered light from the surface of the cosmic body. Results of laboratory detection of luminescence of minerals of meteorites are presented. Results of the comparative analysis of mineral luminescence with unidentified cometary emissions are presented as well. Some other aspects of the problem are under consideration.

References: [1] D'Hendecourt, L. B. et al. (1986) *A&A* 170 (1), 91. [2] Gudipati, M. S. et al.(2003), *ApJ* 583 (1), 514. [3] Simonia, I. (2011) *AP&SS* 332 (1), 91. [4] Gucsik, A. et al. (2012) *MiMic* 18,1285.