

Title of the doctoral dissertation: Some aspects of the physical evolution of comets in the light of modern astrophysical research.

Supervisor: dr hab. Piotr Gronkowski, prof. UR, Department of Theoretical Physics, Faculty of Mathematics and Natural Sciences, University of Rzeszów

Applicant: mgr Marcin Wesołowski, Department of Theoretical Physics, Faculty of Mathematics and Natural Sciences, University of Rzeszów

Abstract

The doctoral dissertation is devoted to the analysis of matter emissions from comets. The dissertation consists of two main parts. First in the part the process of floating dust by sublimed gases from a comet has been analyzed. Three different models of the nucleus shape are considered: spherical, oblate and prolate ellipsoid. In relation to these models two processes are analyzed: the gentle sublimation and the cometary geysers. It was shown that the size of grains, which are raised from a comet, depends significantly on several factors, most important of which are the rate of sublimation of matter comet, the size of the comet's nucleus, its shape and "cometocentric latitude" of on emission place.

In the second part of the dissertation, the very specific phenomenon is presented which is associated with the emission of matter from the comet's nucleus into space and the brightness change of these celestial bodies. It is related with the phenomenon of cometary brightness outbursts. Also, there are presented models of the comets brightness change which are the most frequently debated in the current literature. Astronomers generally believe that the reasons for increasing the brightness of comets are the physico-chemical processes that cause the rejection of some part of the subsurface nucleus layers. In this way, a deeper part of the nucleus is disposed. This phenomenon significantly increases the rate of sublimation of the cometary gases. As a result of this process, the outburst of cometary brightness can be observed. Based on these assumptions, a new cometary outbursts model has been proposed.