Computer Simulation of the Chemical Composition of Comet 2P/Encke

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Abstract. We provide computer simulation and the interpretation of the comet 2P / Encke observation results. It was found that a mixture of ice particles (26%), silicates (38%) and organic matter (36%) give the best agreement between computer modeling and observational data.

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1 Introduction

Comet 2P/Encke, which belongs to comets of the Jupiter family, has the shortest orbital period of all known comets - 3.28 years. On January 23, 2017, series of observations of comet 2P/Encke were carried out at the 6-m BTA telescope of the Special Astrophysical Observatory Kiselev et al. (2020). The observations were carried out at a phase angle of 46.8° using a wide r-sdss filter ($\lambda 6200/1200\mathring{A}$) and an SED500 medium filter ($\lambda 5019/246\mathring{A}$). The results of observations are shown on Fig.1. The photometric color of this comet was also measured (Fig.2, left panel).

2 Computer Simulation

We have implemented a computer simulation of the processes of light scattering by particles of irregular shape, which reproduce real particles of cometary dust. Comet dust consists of very irregular particles. One of the most successful ways to mathematically describe particles of a purely irregular shape was proposed by Muinonen (1996), creating a mathematical model of Gaussian irregular particles

Petrov & Kiselev (2019). The size and shape of a Gaussian sphere is determined by the mean radius and logarithm of the particle radius in the spherical coordinate system $R(\theta, \phi)$. The method of shape matrices, or Sh-matrices, is used to simulation of the dust scattering properties Petrov & Kiselev (2018).

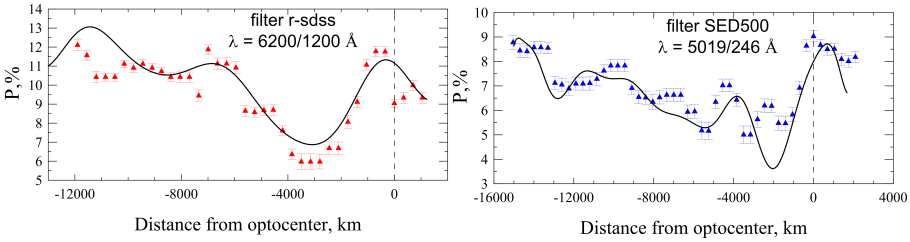

Fig. 1. The degree of linear polarization of the comet in the r-sdss filter (left) and SED500 filter (right).

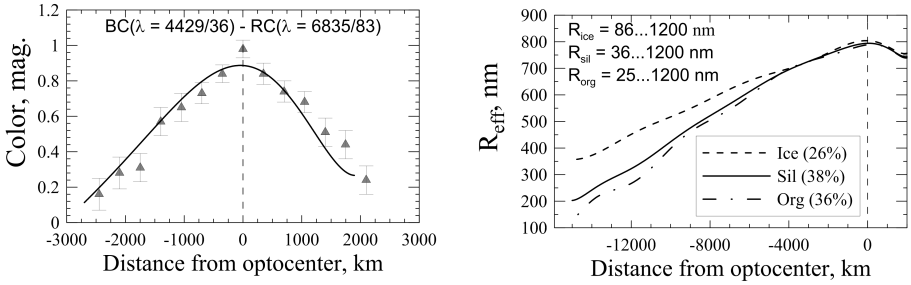

Fig. 2. Photometric color (intensity difference in BC and RC filters) depending on the distance to the optocenter (left) and changes in the effective size of three types of particles with distance from the optocenter.

3 Data Interpretation

With the help of Sh-matrix method, the interpretation of the observation results was carried out. The physical properties and chemical composition of cometary

dust have been determined. It was found that a mixture of ice particles (26%), silicates (38%) and organic matter (36%) give the best agreement between computer modeling and observational data.

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