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The Dust Environment of Comet 81P/Wild 2

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Abstract

This work is a preliminary study focussed on the dust enviroment of comet 81P/Wild 2. We analyze CCD imaging observations during its last perihelion passage in 2010, and perform a Monte Carlo dust tail analysis in order to retrieve the dust environment that best fits the observations. In the first step of the project we use an isotropic particle emission model run more than 8000 parameters combinations. In the next step to fit the complex structure shown by the comet an anisotropic ejection model is required. We include a rotating nucleus with active areas on it. In addition, we also include the asymmetry in the dust parameters respect to perihelion.

1. Introduction

To obtain the best possible fits a wide set of observation covering a large fraction of the comet's orbit is needed. For this work we use thirteen post-perihelion imagen observations of 81P/Wild 2, nine of them during the last apparition in 2010, and four in the previous revolution in 2004, when Stardust Mission arrived the comet [1]. In addition, CCD lightcurves and $Af\rho$ data from amateur observers associaton *Cometas-Obs* during the 2010 passage have been taken into acount. We use a Monte Carlo dust tail analysis to obtain synthetic images of the comet wich allows us to derive the dust parameters: dust loss rate, ejection velocities and size distribution. we developed a modified version of our Monte Carlo code providing a huge number of possible scenarios which allow us estimate the lower and upper limits of dust parameters, providing a useful tool to make a preliminary study.

2. Observations

The observations of 81P were taken by the 1.52 m telescope of Sierra Nevada Observatory in Granada, Spain. We used a 1024x1024 pixel CCD camera with a Johnson red filter. The dates of the observations cover the post-perihelion branch from March 9 to August 21 during nine nights in 2010. In addition, we use images from the previous comet orbit taken with EFOSC2 instrument, during four nights on April 2004 in La Silla Observatory, Atacama. Data were donwloaded from the ESO archive server. The astrometric and photometric reduction were made using Herbert Raab's ASTROMETRICA shareware using the USNO-B1.0 satar catalogue. In order to obtain the best possible fit we also used a CCD lightcurve and $Af\rho$ measurements as a function of the heliocentric distance from amateur astronomical associaton *Cometas-Obs*.

3. Preliminary Results

We used a Monte Carlo dust tail code, wich is developed by our group and used for previus works [2],[3]. In order to find the best possible fit we modify the code for the most simple model i.e. isotropic and symmetrical ejection. With this new version we can reproduce a large number of possible environments and allow us to know the lower and upper limits for the dust parameters. Assuming a particle density of $\rho = 1000\,\mathrm{kg\ m^{-3}}$ and geometric albedo of $p_v = 0.04$ we estimate the dust loss rate in a range 1200-1800 $\mathrm{kg\ s^{-1}}$, a maximum size of particles around 1-3 cm and ejection velocities for particles of 1 cm between 2-4 m/s at perihelion. In order to improve these results an anisotropic ejection model will be implemented. We include in the Monte Carlo code a rotating nucleus with active areas on it. The fit shown in figure 1 corresponds to rotational parameters $\phi = 150^\circ$ and $I = 30^\circ$ with an active area located between 40° and -25°, in agreement with [4] and previously described by [5]. we are still working to improve the results which best fit the observations.

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References

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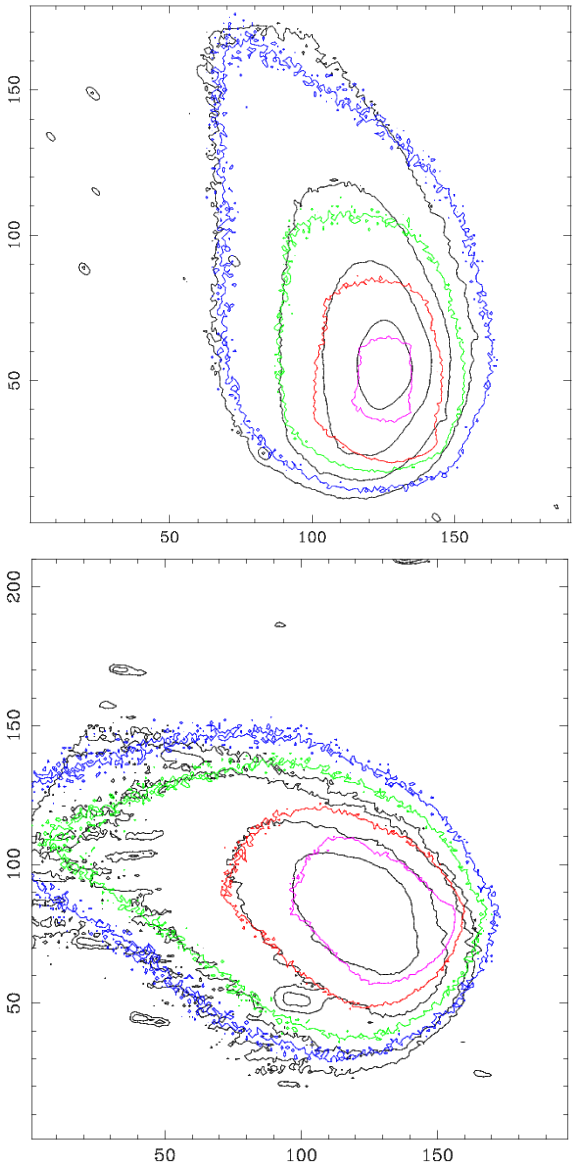

Figure 1: 81P/Wild 2 observations (black isophotes) and model (colored isophotes). Images correspond to the 2010 passage and were obtained using a CCD camera at the 1.52 m telescope of the Sierra Nevada Obserbatory in Granada, Spain. The observation date of the upper panel is 2010-04-08 and for the lower panel 2010-04-20. North up East left.