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An exocomet in the Fomalhaut system: simulating gas and dust emission in a debris disk

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Abstract

A thermophysical model is being used to simulate the behaviour of a cometary nucleus following an orbit in the Fomlhaut debris disc. We study the amount of CO gas and dust released during a typical orbit, and compare them with the ALMA observations. We also evaluate the survival of the body on a very long time span.

1. Introduction

A number of debris disks around main sequence stars have are now been identified [1], and in some of them both gas and dust emissions have been detected. An example is the debris disk in the Fomalhaut system, a planetesimal belt at 140 AU from its A3V star. The system is young, being 440 Myr old, so it can be considered an analogous of the Solar System during the final phases of the formation of its icy bodies reservoirs (Oort cloud and Kuiper Belt). Recently ALMA detected in this debris disc for the first time CO gas emission [2], while dust had already been detected through an excess emission above the stellar photosphere at infrared wavelengths. A question arise about the origin of the gas in the Fomalhaut planetesimal belts: it could be primordial, or released by exocomets during their activy or during collisions.

2. The method

A thermophysical model, developed to simulate icy bodies in the Solar System [3], has been adapted to simulate the behaviour of a comet following an orbit in the Fomlhaut debris disk. The nucleus model is composed by dust, described as a distribution of grains with different sizes, and ices (water, CO_2, CO). The code solves the coupled equations of heat transfer and gas diffusion, accounting for the stellar radiation reaching the surface, heat conduction in the interior, heat advection by gases, sublimation of ices, amorphous-crystalline ice transition and gas and dust fluxes from the nucleus. The dust grains are released by the sublimation of the ices and undergo the drag exerted by the escaping gas. The model is being used to compute the amount of gas and dust released from the nucleus along an orbit, both in presence and absence of gas from the circumstellar disc. The chosen orbit has the aphelion at 170 au and the perihelion at 140 au. We are willing to study the amount of CO gas and dust released during a typical orbit, and compare these emissions with the ALMA observations. We are also willing to derive the total mass lost by the exocomet during an orbit and study its long-time activity of the comet, in order to evaluate the survival of the body on a very long time span.

3. Conclusions and future works

From the initial results it appear difficult to explain the observations performed by ALMA of the Fomalhaut beris disk taking into account only the typical cometary activity, that is without considering, for example, the effect of collisions between icy bodies.

References

[1] Hughes, M., et al.: Debris disks: structure, composition and variability, Annu. Rev. Astron. Astrophys., 56, pp. 541-591, 2018

[2] Matrà, L. et al.: Detection of exocometary CO within the 440 Myr old Fomalhaut belt, The Astrophysical Journal, 2017

[3] Capria, M.T. et al.: How pristine is the interior of the comet 67P/Churyumov-Gerasimenko?, MNRAS, 469, pp. S685-S694, 2017