CHARACTERIZATION OF THE INTERNAL STRUCTURE OF COMET 67P/CHURYUMOV-GERASIMENKO USING THE CONSERT EXPERIMENT DATA. M. Benna¹ and J.-P. Barriot², ¹NASA-Goddard Space Flight Center, Code 699, Greenbelt, MD-20771, USA (mehdi.benna@gsfc.nasa.gov), ²LDTP, Observatoire Midi-Pyrénées, 14 av. Edouard Belin, F-31400 Toulouse, France (Jean-Pierre.Barriot@cnes.fr).

Abstract: In this paper we present the latest results of the modeling of the CONSERT experiment (Comet Nucleus Sounding by Radio-wave Transmission). This novel experiment is part of the scientific package equipping the Rosetta spacecraft and will study the nucleus of comet 67P/Churyumov-Gerasimenko in 2014.

The CONSERT experiment aims to characterize the internal structure of the cometary core in term of heterogeneity distribution by analyzing time-delays and phase perturbations affecting radiowaves propagating through the nucleus. The principle of this experiment is detailed in [1] and [2]. To prepare the CONSERT scientific operations, dedicated instrument simulations and data processing techniques are under investigation. We showed in previous works [3,4] that the Ray-Tracing Method (RT) is an efficient way to simulate waves propagation in a two-dimensional nucleus model and that a Tikonov-like inversion scheme is capable of reconstructing the nucleus interior and to characterize its structure and composition.

In this presentation, we generalize the use of the RT technique to three-dimensional models with plausible nucleus shapes and realistic internal structures. We show that CONSERT is capable of detecting characteristic signatures leading to the identification of the gross distribution of the comet material (homogeneity, stratifications, chunks, etc.). Using these signatures as a priori information, we present examples of image reconstruction of the nucleus interior for several orbital configurations (example Figure 1). We finally show the impact of the spacecraft orbital configuration and the volume of the recorded CONSERT data on the quality of the inversion result.

References:

Figure 1: Example of a nucleus reconstruction result: (Upper fig.) Cross section of the original nucleus model (with a background permittivity= 2). (Lower fig.) Reconstruction using the phase perturbation and a priori values for the surface permittivity perturbations.