

SCIENTIFIC REPORT - ESF SHORT VISIT GRANT 4313

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1

PURPOSE OF THE VISIT

The purpose of the Short Visit was to prepare the analysis of the ESA space mission Gaia with respect to its capabilities in comet science. As a first step, the detectability of comets by the on-board software, depending on the cometary parameters such as nuclear magnitude, dust activity, or differential velocity in the sky, has to be studied. The experience available at the Universities of Coimbra (Portugal) and Barcelona (Spain) in simulating comet observations for Gaia and analyzing them were to be exchanged during the visit.

WORK CARRIED OUT DURING THE VISIT

All preparative work required for a systematic study of the detectability of comets with Gaia was completed during the visit. This includes:

- A discussion of all physical effects that have to be included in simulations of Gaia comet observations for this purpose.
- Agreement on the range of parameter space (including e.g. the nuclear magnitudes, dust activity, differential velocities, coma asymmetries) that has to be investigated was obtained.
- All participants in the collaboration were introduced to the usage of the Gaia pixel level data simulator GIBIS. This includes the simulation of Gaia comet observations with GIBIS and the usage of the Astrium prototype of the on-board detection software on such simulated data.
- Future steps required in the analysis of Gaia's capabilities for comet science were discussed.

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DESCRIPTION OF THE RESULTS OBTAINED

Concerning the simulation of comet observations it was agreed during the visit that a steady-state dust model making use of the $Af\rho$ -formalism will be used, neglecting the phenomenon of dust jets in the inner coma. Coma asymmetries will be included in the simulations.

The contribution of gas emissions to the Gaia comet observations will be neglected. Such simulations can be performed with the currently available simulation tool GIBIS. The on-board prototype detection software can be applied to such simulated data.

It was agreed that future investigations should include simulations of all Gaia observations of a particular comet over the whole nominal mission timeline.

FUTURE COLLABORATIONS

The collaboration between the Universities of Coimbra and Barcelona started with this Short Visit will continue. A systematic study of the detectability of comets over the whole range of meaningful comet parameters will be performed during the next months. Furthermore, the capabilities to simulate particular comets on specified orbits over the whole Gaia mission will be developed.

PROJECTED PUBLICATIONS

It is foreseen to publish the results of the study currently ongoing in a refereed journal. However, as this Short Visit only marks the beginning of the collaboration, the time of publication cannot be specified at this point.