

Starting up a Data Model for Exoplanetary Data



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The effort for searching, studying and characterising extrasolar planets and planetary systems is a growing and improving field of astrophysical research. Alongside the growing knowledge on the field the data resources are also growing, both from observations and numerical simulations. To tackle **interoperability** of these data an effort is starting (under the EU H2020 ASTERICS project) to delineate a data model to allow a common sharing of the datasets and collections of exoplanetary data. The data model will pick up model components from the IVOA specifications, either existing or under investigation, and attach new ones where needed. Here are presented the first results in drafting the exoplanetary systems dedicated data model. Relationships are reported with existing and proposed IVOA models; new key components not yet available in the interoperable scenario are shown. The results here reported cover a first set of requirements and considerations and take into account aspects like the observations of exoplanetary systems, the usage of existing exoplanets catalogues, the investigation of atmospheres of confirmed exoplanets and the simulation of exoplanet's atmospheres devoted to characterize exoplanets habitability.

Starting from experiences on:

- ⊕ time series of radial velocities to confirm and characterise exoplanetary systems;
 - ⊕ analysis of exoplanets catalogued data;
 - ⊕ simulations of planetary atmospheres to define habitability;
 - ⊕ radial velocity and photometric investigation of exoplanets;
 - ⊕ exoplanets atmospheres observations;
- a basic model of planetary system data has been sketched (figure 1 on the right is the resulting sketch).

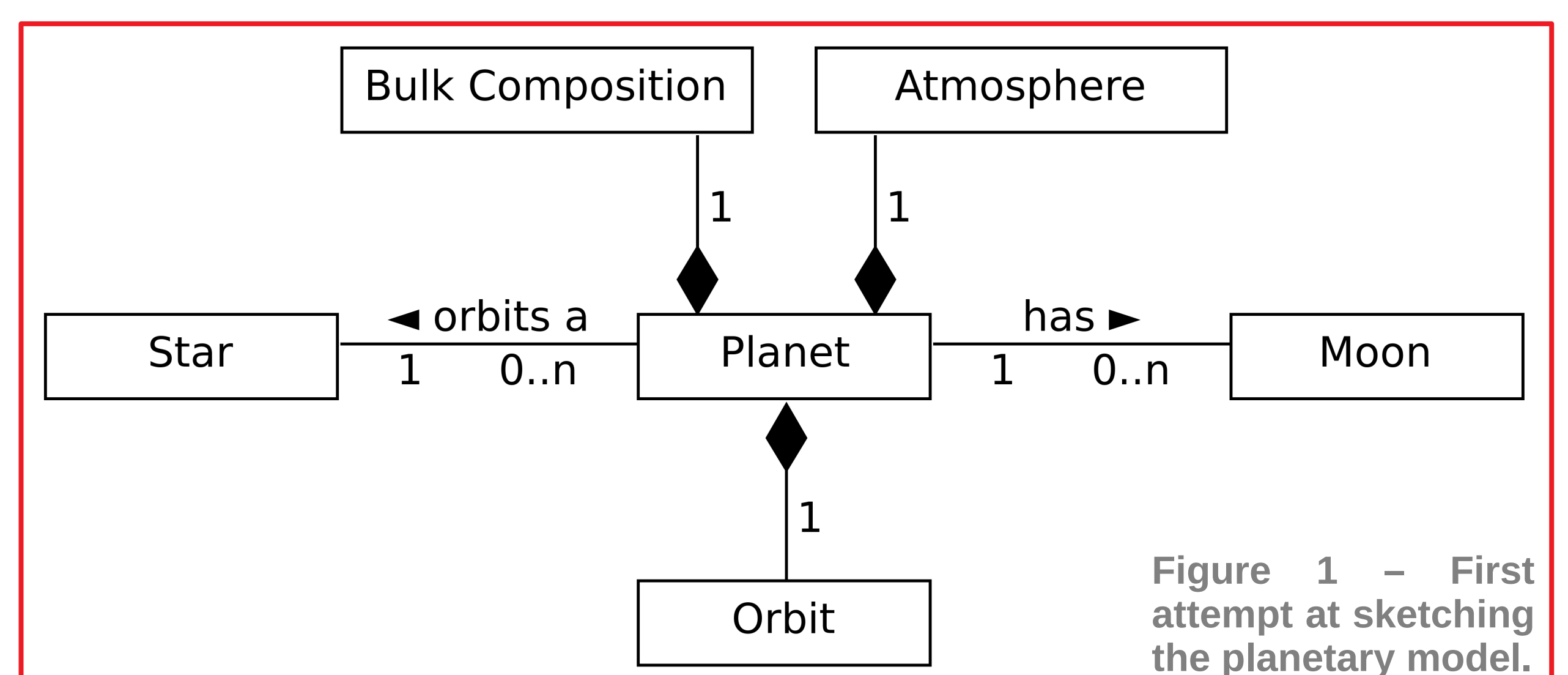


Figure 1 - First attempt at sketching the planetary model.

The preliminary basic model above does not include the classes, derived from the atmosphere simulations, that detail the experiment description and datasets output. Those will be respectively referenced from the existing **Simulation Data Model** and **DataSet Metadata - Cube - TimeSeries** data models of the IVOA.

Another point of contact with the IVOA works is represented by the **Star** class, which is considered to be a reference to the ongoing **Source Data Model** effort.

The main point to move from a model like the one in Fig. 1 to the more general solution in Fig. 2 (on the left) is the fact that an orbit is a concept related to a couple of **Celestial Object(s)**, one of which is considered the child and the other the parent one.

This solution, besides solving the flaw of considering the **Orbit** as a component to a **Planet** (or a single object), helps in directly considering satellites and other objects in the general scenario.

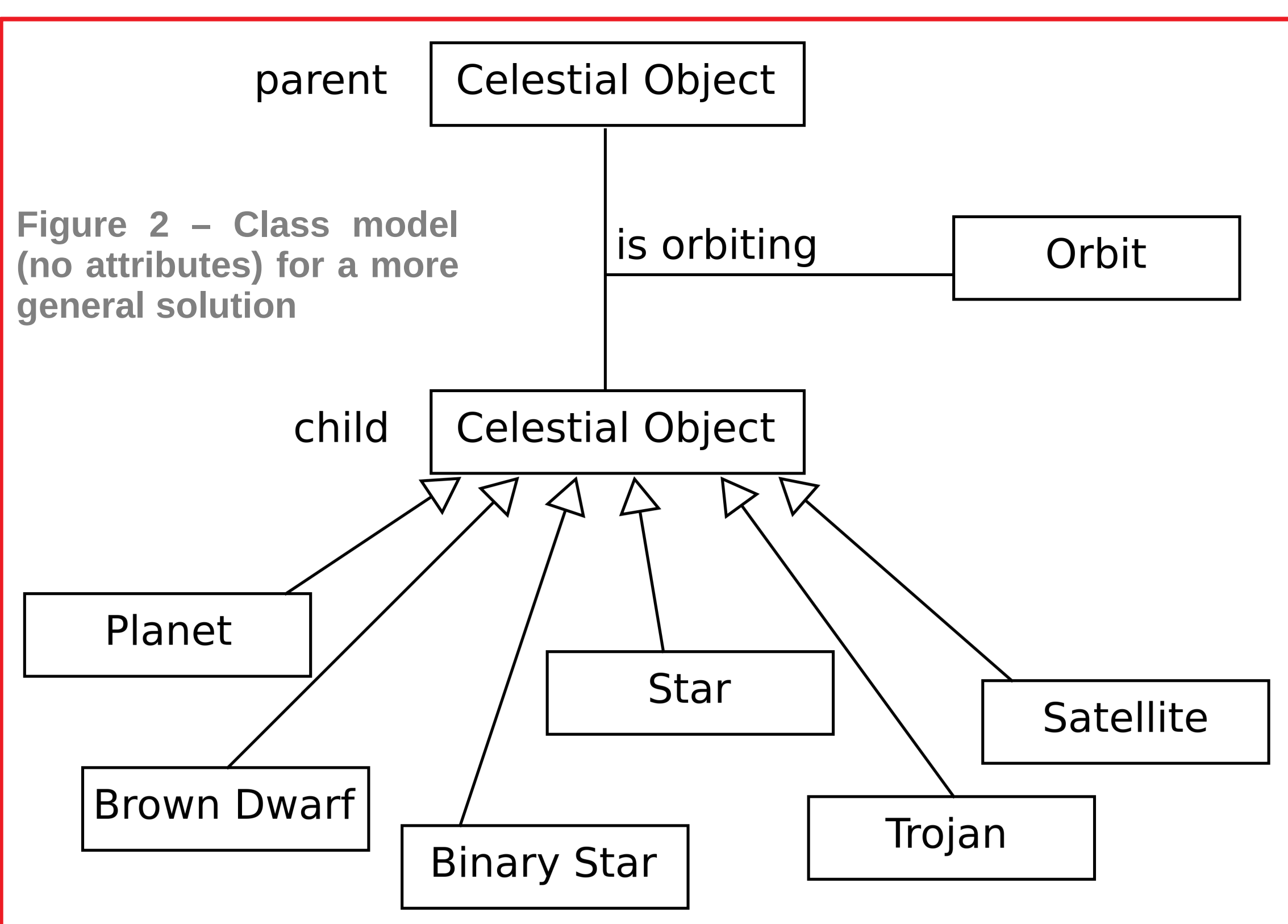


Figure 2 - Class model (no attributes) for a more general solution

Sub-typing the **Celestial Object** class we then define the various actors in the (exo-)planetary system scenario allowing flexibility for data to come in the near future. Also, the connection to the **Source DM** is preserved. An open point is the one about a binary stellar system has the planetary system's host (ternary or multiple-star hosts are not currently the case). There are cases where planets orbit one of the stars in the binary system, and there are cases where planets orbit the common binary center of mass. This is currently considered in the model allowing for a **Binary Star** sub-class, but a solution based on the chunk sketch from Fig. 3 will be kept in mind (though it opens up for a more complex model).

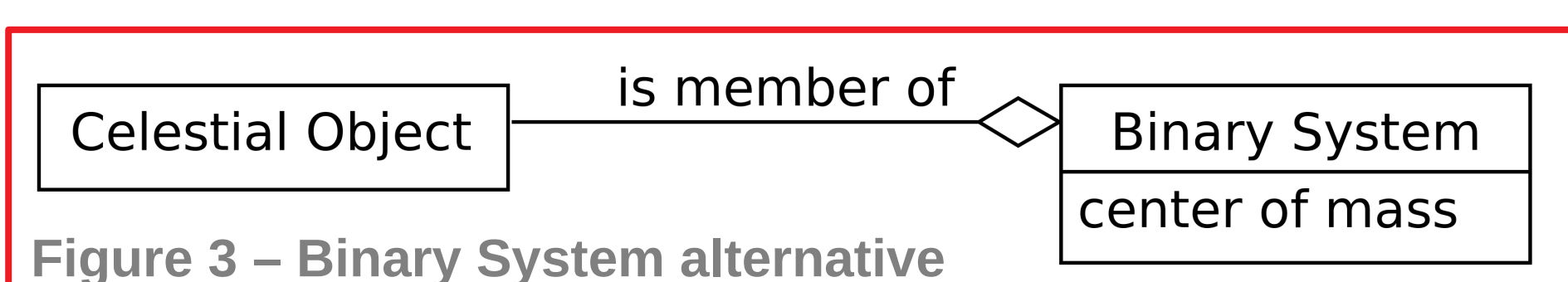


Figure 3 - Binary System alternative

Next steps in this modelling effort will focus on widening the community contribution of requirements and details (at least for what concerns class's attributes) and a tighter connection with the related modelling efforts.



Authors Marco Molinaro, Andrea Bignamini, François Bonnarel and Mireille Louys acknowledge funding by the ASTERICS project, supported by the European Commission Framework Programme Horizon 2020 Research and Innovation action under grant agreement n. 653477



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Extended notes from the meeting

