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Astrocomp: A Web Portal for High Performance Computing on a Grid of Supercomputers

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Abstract. Astrocomp is a project based on a collaboration among the University of Roma La Sapienza, the Astrophysical Observatory of Catania and ENEA. The main motivation of the AstroComp project is to construct a portal, which allows to set up a repository of computational codes and common databases, making them available and enjoyable, with a user-friendly graphical web interface, to the international community. AstroComp will allow the scientific community to benefit by the use of many different numerical tools implemented on high performance computing (HPC) resources, both for theoretical astrophysics and cosmology and for the storage and analysis of astronomical data, without the need of specific training, know-how and experience either in computational techniques or in database construction and management methods. An essential feature of Astrocomp is that it makes available to subscribers some CPU time on large parallel platforms, via specific grants. Astrocomp is partly financed by a grant of the Italian national research Council (CNR).

1. Present Project Status and Description

The main aim of the AstroComp project is to create a portal that provides both astrophysical numerical codes and platforms to run them, with no need by the user to get grants or to pay expensive computational resources. A prototype of the AstroComp portal is already working and can be visited at `http://www.astrocomp.it` (see Figure 1), where it is possible to find a description of the main features of the project. Clicking on the *Software* session, it is

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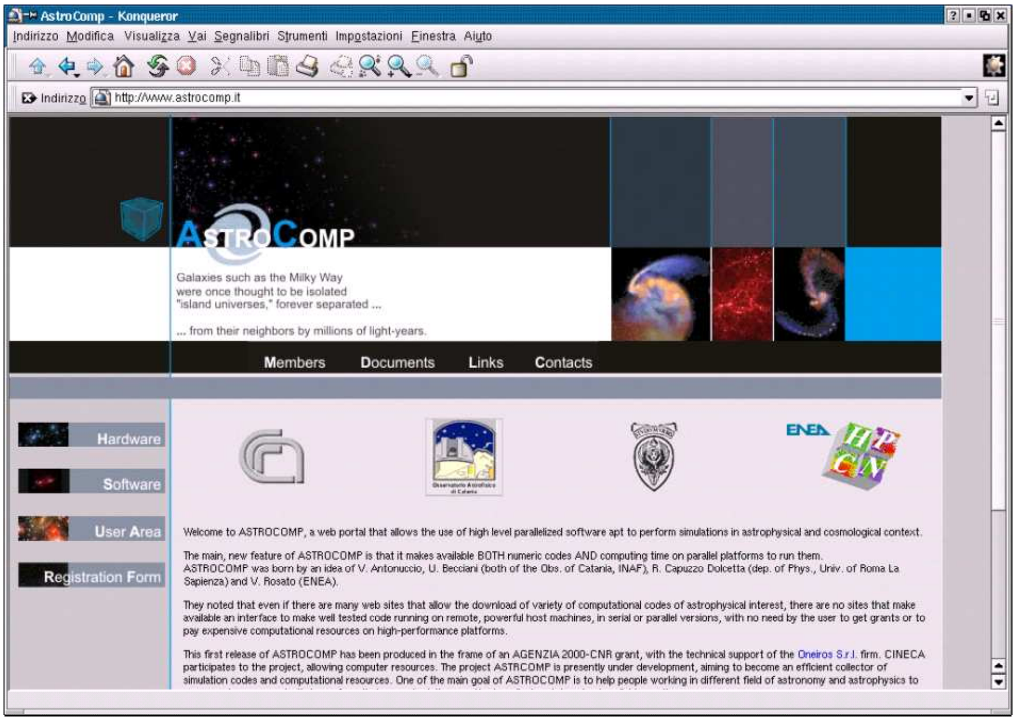

Figure 1. Home page of the present version of the AstroComp web portal.

possible to find a description of the codes that are presently available through the portal. At the present stage, AstroComp hosts three N-body codes:

1. the *ATD* treecode, a parallel tree-code for the simulation of the dynamics of self-gravitating systems (Miocchi & Capuzzo Dolcetta 2002);
2. the *FLY* code, a cosmological code for studying three-dimensional collisionless self-gravitating systems with periodic boundary conditions (Becciani & Antonuccio-Delogu 2001); and
3. the *HSN*body, a direct-summation code which is presently under implementation into the portal (Di Matteo, 2001).

ATD and *FLY* have been already tested and are fully working on the server. The main features of the platforms now available to run these codes can be found clicking on the *Hardware* session, from the AstroComp home page. At the moment, the portal can provide four machines: an IBM SP4 and a SGI Origin 3800 (both located at CINECA), a Linux Alpha Cluster (located at ENEA Casaccia Research Center) and an IBM SP3 (located at the Catania Astrophysical Observatory).

Anyone who wants to use the provided facilities has to register first, doing the following steps:

1. click on the *Registration Form*, available from the AstroComp home page and fill the form, entering personal data and e-mail address; and

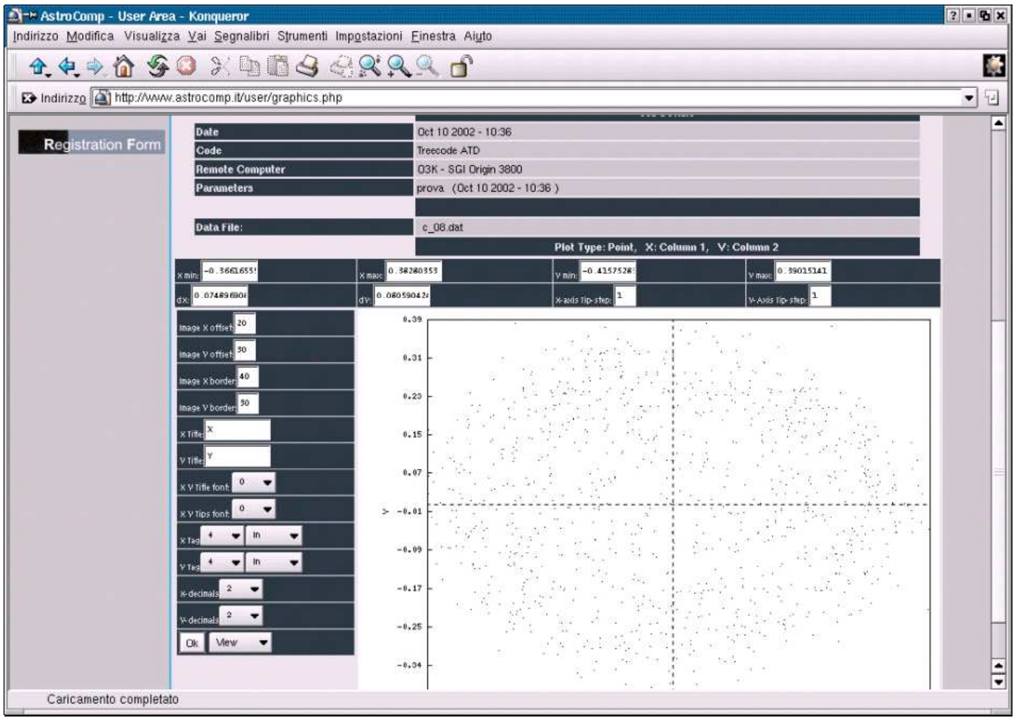

Figure 2. The 2-D plot page available from the AstroComp portal.

2. wait for a confirmation e-mail sent quickly by the portal administrator as soon as the account is added for the new user, with the username and password he will have to use to enter in the *User Area*.

Clicking on the *User Area* button, after a usual login procedure, any registered user can have the access to the computational facilities of the AstroComp portal.

At present, an AstroComp user is able to:

- start a new simulation by choosing which code to run and by determining the simulation parameters via the *Parameters* on line form; and
- choose among different platforms from the pool of the available resources;

or

- browse the status of a previously launched job, possibly checking the intermediate results with a preliminary "on-the-fly" visualization tool available in the portal itself (see Figure 2); then
- download the final and/or intermediate results.

In the first case, if the user wants to start a new simulation, after the code he wants to run has been chosen, he has to assign the parameters of his own simulation. Two possibilities are available: the user can choose either to use the AstroComp default values (described in the *New Job* session) or to give his own parameters. After having entered all these parameters, a name can be given to the job. The last step to do, before submitting the job, is to give the initial configuration files. Also in this case it is possible to choose either to use the AstroComp default files or to assign others.

If the user wants to check the status of a previously launched job, he has to click on the *Job Status* button (in the *User Area* page). Here he will find the list of the submitted jobs, the dates of the submissions, the job status (pending, not in queue or running) and the platform used to run it. Clicking on the *Results* button from this list, it is possible to see the list of the files produced by the simulation.

The user can choose either to delete files (in this case he will lose them definitely) or to plot them, using a visualization tool available on the portal itself. Plotting the files could be useful to check the simulation results.

2. Near Future Perspectives

Many improvement are planned to be carried out in the short-term activity. They include:

- implementation of on-line tools for the automatic generation of the most used and relevant initial conditions for astrophysical/cosmological simulations;
- implementation of scheduling methods for the management of very-long term simulations by subdividing them in shorter "sub-simulations" that could satisfy the CPU times restrictions of the various queue job systems; and
- inclusion of advanced data analysis and storage tools (for example, AstroMD, Becciani et al. 2000).

To conclude, note that the AstroComp server is based on a PHP/MYSQL environment and that the databases structure has been designed with the capability of an easy interface with the middleware and the Resource Broker for a future grid-based computational environment.

Anyone who is interested on this project and wants to add astrophysical codes to the portal can contact us, sending an e-mail to one of the AstroComp members (e-mail addresses are available in the *AstroComp Members*[1] page).

References

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[1] `http://www.astrocomp.it/members.it`