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# Automatic Detection of Gravitational Arcs

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## Describe the scientific/technical community and the scientific/technical activity using (planning to use) the EGEE infrastructure. A high-level description is needed (neither a detailed specialist report nor a list of references).

Gravitational arcs are highly distorted and often magnified images of very distant galaxies. These images are caused by the gravitational lens effect and are extremely useful tools for various astrophysical purposes, e.g. mass determinations of the lens, investigations on the very early universe and even cosmological studies.
However, these objects are usually very thin and faint structures and are therefore very hard to detect, in particular on Wide Field images.

## Report on the experience (or the proposed activity). It would be very important to mention key services which are essential for the success of your activity on the EGEE infrastructure.

We have access to astrophysical images taken with various instrument/ telescope combinations containing proven gravitational arcs. Therefore we are able optimize the parameter sets to each individual of these instrument/telescope combinations we have in use. This will be done by varying the parameter values within meaningful ranges, which are already roughly constraint. In particular, we expect the job type Parametric" offered in the GLite middleware to be very useful for our purposes. The future use of the EGEE infrastructure with its tremendous computing power offers also the possibility for a much larger number of parameter value combinations compared to Beowulf clusters. Also the step size of the value variation can be decreased dramatically.

## With a forward look to future evolution, discuss the issues you have encountered (or that you expect) in using the EGEE infrastructure. Wherever possible, point out the experience limitations (both in terms of existing services or missing functionality)

We will further constrain the parameter space in a first step. This is necessary as an inappropriate set of values may cause a dramatic increase in

computing time. The
second step will then be the main parameter study. Both steps
have to be done for
each individual instrument separately.

## Describe the added value of the Grid for the scientific/technical activity you (plan to) do on the Grid. This should include the scale of the activity and of the potential user community and the relevance for other scientific or business applications

We have developed a new algorithm for an automated detection of
these useful objects.
This algorithm consists of mainly four steps: (1) a small
Gaussian presmoothing, (2)
histogram modification for defining the expected dynamic range of
the arcs, (3)
anisotropic filtering, which is a direction depended smoothing
for enhancing arc-like
structures, and, finally, (4) the selection of the arc
candidates, which is done by
defining selection criteria. All four steps depend on various
parameters having large
influence on the final detection success. However, this set of
parameters has to be
optimised for each individual combination of the used
telescope/detector setup, as
images of the same object taken with different instruments
differ, e.g. in depth or
resolution. Therefore the use of EGEE resources offer the
possibility to perform
parameter studies on each single setup. Once performed we expect
this parameter set
to be very useful for all astrophysicists working working on this
topic.

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