

'Through the looking glass' - the Universe at your computer

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Astronomers throughout the UK now have a valuable new research tool at their disposal which may lead to new discoveries and improved understanding of the physics of the Universe. Launched this week, AstroGrid provides a unique way of accessing, processing and storing astronomical data obtained from a diverse range of data archives held anywhere on Earth. AstroGrid will open the way for virtual observing on individual computers, enabling astronomers to compare and manipulate a wide range of astronomical data taken from both ground and space-based telescopes.

Astronomy is now in a golden age of discovery, with many new breakthroughs being made with the availability of high quality observations of the cosmos from major new observational facilities, such as the European Southern Observatory's Very Large Telescope [VLT] in Chile and the European Space Agency's XMM-Newton space-based observatory, which provide information across a wide range of the electro-magnetic spectrum from radio to visible light to gamma rays.'

The data taken from ground and space-based observations are held in separate archives and the challenge has been to provide the astronomer with the ability to bring these various pieces of data together, enabling them to understand the wider picture. For example one astronomer may survey the sky in the optical wavelengths, using the Sloan Digital Sky Survey, whilst another astronomer may analyse data from the XMM-Newton, each resulting in different answers. Only by comparing the two sets of data, or even adding another data set (e.g. Infrared data from

Spitzer), can they then discover that certain previously insignificant faint objects seen in the optical are in fact distant galaxies harbouring massive black holes at their core.

Nic Walton, AstroGrid's Project Scientist, said 'This first phase of the AstroGrid Virtual Observatory system represents a major milestone, unifying for the first time, the mass of astronomical data available to the astronomer, thus offering the potential to significantly increase the rate at which astronomers gain new insights into our Universe.

AstroGrid, the UK's Virtual Observatory, will achieve this by providing a system that allows an astronomer to gain access to data not just from one telescope, but from all telescopes. AstroGrid makes use of the latest developments in distributed computing to enable the access and manipulation of large amounts of data (for example the whole sky imaged in one colour is 100 TB1. More importantly it implements standards that it has agreed with other partner projects across the globe (through the so called International Virtual Observatory Alliance) in order to ensure that data from any telescope can be described and understood by automated systems, thus making large scale analysis of the data on distributed computing systems much easier.

Andy Lawrence, the AstroGrid Project Leader from Edinburgh, said "When you browse the Web it feels like all the world's web pages are sitting there inside your own computer. The idea of the Virtual Observatory is to achieve the same transparency for data and tools - astronomical databases and lots of analysis tools are spread all over the Internet, but they feel like they are inside your laptop, waiting to work with, and all speaking to each other. This is an ambitious vision, but with this first AstroGrid release it begins to look like a concrete reality".

The [latest release](#) of AstroGrid is now being used by a wide range of astronomers to address a number of astrophysical problems. For

instance, the impact of our Sun's solar eruptions on the Earth's magnetosphere is being studied through the linkage of various models and data archives linked via AstroGrid. In another example, massive multi-wavelength data is being analysed in an attempt to reveal the star formation histories of the earliest galaxies.

Using AstroGrid an astronomer can request sets of observations of the same area of sky taken by several different telescopes and combine the data; perform the same analysis on all the data simply by setting up a set of commands in the AstroGrid system. Previously each data set would have to be processed individually, taking much longer to get results.

Professor Keith Mason, CEO of the Particle Physics and Astronomy Research Council, which funds AstroGrid, said 'It is essential to compare and mix data from different sources in order to maximise the information we can glean from modern astronomical data. These tools will undoubtedly lead to new discoveries about the Universe that would have previously gone unnoticed.'

[AstroGrid](#) is a consortium of Universities funded by the Particle Physics and Astronomy Research Council as part of its eScience programme with additional funding through the European Commission's Framework 6 programme.

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