

New experiment could reveal make-up of the Universe

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The new experiment will help understand the structure of all matter in the Universe

(PhysOrg.com) -- Scientists at the University of Liverpool are constructing highly sensitive detectors as part of an international project to understand the elements that make up the universe.

The detectors will become part of the Advanced Gamma Tracking Array (AGATA) experiment, currently based in Italy, which aims to create a 'fingerprint' of the inside of the [atomic nucleus](#) to understand the structure of all matter in the [Universe](#), including human beings and the stars.

The experiment will help scientists analyse particle interactions that produce gamma rays, which are also commonly used for their penetrating properties in medical diagnostics and treatments such as PET

scans and [radiation therapy](#). Scientists will use these interactions - and the energy required to make them - to probe rare 'exotic' nuclei. These are formed by nuclear reactions, which occur in the heart of stars as well as the large [accelerator](#) facilities used to study them on earth.

Exotic nuclei are difficult to detect and consist of extreme proton and neutron ratios, making them highly unstable. The new experiment will help scientists understand why some nuclei are more stable than others and why they have a wide variety of different shapes.

The University's Department of Physics is home to the only gamma ray detector scanning system in Europe. The machine will scan the new detectors to help 'read' the signals produced by AGATA so that scientists can understand the properties required to create and sustain life in the Universe.

Dr Andy Boston, from the University's Department of Physics, explains: "There is a huge abundance of elements in the Universe, but we know very little about why this is. We can only begin to understand how these are formed by looking at a broad spectrum of nuclei, beyond those available on earth. We look at the stars to do this because they contain exotic nuclei. These nuclei have extreme proton and neutron ratios which make them unstable and decay very quickly, until the stable nuclei we have on earth are left behind.

"If we can understand the structure of these exotic [nuclei](#) then we can begin to understand the abundance of elements in the Universe today. State-of-the-art computers will help us do this by reconstructing the path of gamma rays around the new detector and recording the energy created.

"This energy, which is characteristic of the energy inside a nucleus, will help us create a 'fingerprint' of elements that make up our universe and

produce a picture that will further understanding of how we interact with the natural world."

Technology built for AGATA will also help improve gamma-ray machines for medical imaging, as well as provide the expertise to develop portable radiation monitors that could be used by security services to detect dirty bombs and monitor radioactive waste.

Source: University of Liverpool ([news](#) : [web](#))

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