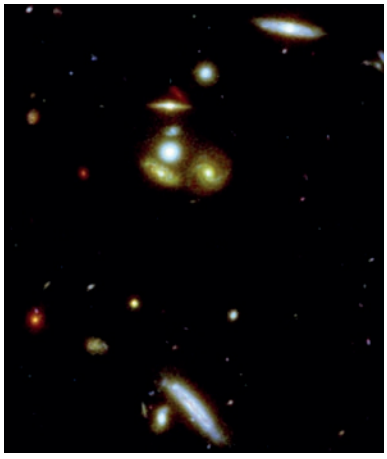
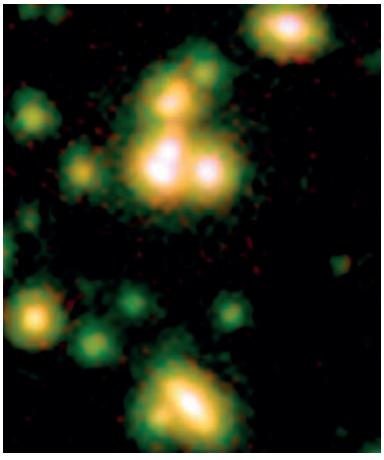
From the space come the answers on the future

Astrodeep, the power of deep images

It is said that a picture is worth a thousand words. This is also true in astrophysics: images from telescopes tell us the most important history of all, that of the entire universe. By observing objects that are further and further away - whose light comes from billions of years ago - you can rebuild history, back in time almost to the moment of the Big Bang. The images that allow this, in astronomy slang are called "deep" images. The Astrodeep project was started with an ambitious goal: to put European astrophysics in a position of leadership in the use of these deep images. In order to do this, researchers developed new technology for the analysis of the images, to then apply them to the data from the best Esa and Nasa satellites, and telescopes on the Earth. The main problem they faced can be seen in the photographs accompanying this article. These show a small part of a deep image, a tiny slice of a piece of sky the size of one ten-thousandth of the moon, taken by the Hubble Space Telescope. The objects that can be seen are galaxies, of various size and shape, from 3 to 12 billion light years away from earth. This is data that tells us how the progenitors of the Milky Way and other nearby galaxies were. To study them better, we have to match them with those from other telescopes on earth and in space, like those on Nasa's Spitzer satellite, as shown in the figure. Unfortunately, as these images were obtained with a different wavelength from Hst, the images have the same quality, but a lower resolution. Astrodeep has tackled this problem by developing new techniques of "deconvolution" on the images to recover hidden information in the more confusing ones. The principle is to use the best images as the main information which is used to bind in a statistically rigorous manner the analysis of the lower resolution images. To obtain these results, they formed an international team including young researchers from many European and non-European countries. They combined their know-how and mathematical image analysis techniques, statistics and astrophysics. Thanks to Astrodeep's results, researchers can rebuild the history of the galaxies with a never-before achieved precision. The future effects of these developments are important.

Adriano Fontana





Primordial galaxies

The technology developed by Astrodeep has been adopted by the Esa for the analysis of satellite Euclid, which will be launched in 2020, to resolve the mystery of "dark matter" and "dark energy". In the meantime they are also studying how to extend their image analysis techniques into other areas of research, including medical applications like the automatic recognition of skin lesions which could turn into cancer. The adventures in deep space have only just begun...