A population of compact elliptical galaxies detected with the Virtual Observatory

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Compact elliptical galaxies (cE) are rare objects, which are usually observed as neighbours of massive galaxies, such as Messier 32 around Andromeda. Since their metallicity is high, contrary to what is expected from low-mass systems, they are thought to be the remnants of more massive galaxies, that have been stripped by the tidal forces of their neighbours. A team of international researchers, led by two astronomers from Paris Observatory, has enlarged considerably the number of known cE through data mining the Virtual Observatory. This allows them to check their formation mechanism.

Modern observatories produce a growing avalanche of astronomical data. Rare objects in this flow resemble needles in a haystack, where the International Virtual Observatory becomes a magnet. Compact elliptical (cE) galaxies such as Messier 32, a satellite of the Andromeda system, provide an example of a unique class including only a handful of known members. They supposedly originate from larger systems severely stripped by the tidal forces of their host galaxies conversely to the majority of galaxies which are believed to form through hierarchical merging.

Igor Chilingarian and his collaborators have used the Virtual Observatory technologies to discover 21 compact elliptical galaxies in the archival data by automated analysis of Hubble Space Telescope images of nearby galaxy clusters. They confirmed 14 of them by using large catalogues and analysing Sloan Digital Sky Survey spectra. They then followed up 7 galaxies with the Russian 6-meter telescope and obtained properties of their stellar populations. Metal-rich dynamically hot stellar populations of the discovered galaxies argued for their formation by the tidal stripping of more massive progenitors.

Finally they model the effects of tidal stripping by means of numerical simulations. They successfully reproduced observed properties of newly revealed compact elliptical galaxies. Their discovery of a fairly large population of cE galaxies argues for the importance of tidal stripping in galaxy evolution.

This study is a proof of the e-Science concept followed up by real physical and numerical experiments applied to the studies of galaxy evolution. Thanks to the technological development and progress in computer and network hardware and software, it is possible to foresee growing amount of e-Science powered studies to arrive in near future.
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Figure : Image obtenue avec le télescope spatial Hubble de la région centrale de l’amas de galaxies Abell 397. Deux galaxies elliptiques compactes (cE#1 and cE#2) sont détectées, voisines de la galaxie la plus massive de l’amas, dans le coin en bas à droite.