



Contribution ID: 14

Type: Oral Presentation

## Computational Morphometric Analysis in Astrophysics and Cosmology

*Monday, 11 July 2016 12:00 (20 minutes)*

**Abstract content** `<br>` **(Max 300 words)** `<br>` `<a href="http://events.saip.org.za/getFile.py/?target="_blank">` **Formatting &** `<br>` **Special chars** `</a>`

We discuss the state of the art in morphometric analysis of galactic structures in astrophysical and cosmological scales. From the practical point of view, we present a hybrid many-core Mic60/K40 computational morphometric system to automatically analyze structure and pattern formation in astrophysics (e.g. galaxy classes) and cosmology (e.g. filaments, voids and “Zeldovich-pancakes”). The system includes the original and modified versions of the following coefficients: Concentration, Asymmetry, Euler Characteristic, Smoothness, Entropy and Spirality. Using a sample of spiral and elliptical galaxies from the Galaxy Zoo project as a training set, we employed the Linear Discriminant Analysis technique to classify SDSS Legacy (779,235 galaxies) samples. The cross-validation test shows that we can achieve an accuracy of more than 86% with our classification scheme. Therefore, a plane in the morphometric parameter space can be defined which separates the elliptical and spiral classes with a mismatch between classes smaller than 10%. The distance to different space parameters planes as a morphometric index is also useful to characterize structure formation in large-scale structure simulation as from the galactic systems simulated from Millenium and Illustris projects. A selection of quite new methodologies and applications are presented within the context of Data-Intensive Scientific Analysis related to the main data repositories available for extra-galactic astrophysics research. The main challenges in hybrid/heterogeneous computer science for those purposes are addressed.

**Primary author:** Dr ROSA, Reinaldo (Lab for Computing and Applied Math - INPE-MCTI)

**Co-authors:** Mr STALDER, Diego (IAP-France); Dr DE CARVALHO, Reinaldo Ramos (DAS-INPE-MCTI); Mr SAUTTER, Rubens (CAP-INPE)

**Presenter:** Dr ROSA, Reinaldo (Lab for Computing and Applied Math - INPE-MCTI)

**Session Classification:** Parallel Track A: Astrophysics and Space Physics, Plasma, Gravitation and Cosmology

**Track Classification:** Astrophysics and Space Physics