PGOS3: A DATABASE OF SYNTHESIS MODELS IN THE VO

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ABSTRACT

We present PGos3, a database of evolutionary synthesis models and atmosphere libraries that compiles the Single Stellar Populations (SSP) results from different authors, covering more than 90% of the models used in the literature. PGos3 provides access to the models via WWW and in VOTable format accessible using TSAP protocol. Currently, a restricted version of the database is accessible from VOSpec; the complete database will be released at the end of summer 2007.

Key words: Stellar populations; Synthesis models; Virtual Observatory.

1. INTRODUCTION

In the context of modern astronomy, with large facilities and huge observational databases, it is not only needed to establish different methods of data sharing but also to develop tools that allow to efficiently obtain physical information from the data. In this context, the *Cathedral Legacy Tool* project (P.I. R. Terlevich & A. López) aims to produce a cooperative tool that allows to perform a *physical analysis* of astrophysical data. Although the first attempts to define this project date from early 2004 and without relation with the Virtual Observatory (VO), the development of VO naturally solves some of the technical issues inherent to the project, which is now advancing in the context of the VO framework.

The main subject of the *Cathedral Legacy Tool* project is the analysis of stellar populations in galaxies. This task naturally requires of (i) observational data sets, (ii) theoretical models (in particular evolutionary synthesis models), and (iii) efficient analysis tools that combine observational and theoretical data and return the relevant physical quantities that describe the evolution of galaxies.

Observational data are currently provided in a very efficient way in the VO. However, this is not the case with specific analysis tools and theoretical data sets, mainly due to the absence of data sets of theoretical synthesis models in the VO framework[1]. Therefore, most of current analysis tools are specific to particular synthesis models (or set of models) thus producing model dependent results, without the possibility of exploring the variety of theoretical models available in this area of astrophysical research.

2. THE PGOS3 DATABASE AND VO DEVELOPMENTS

PGos3 (P.I. E. Terlevich & M. Cerviño) was born as a medium-term solution to access to theoretical models. The data set aims to provide VO access to Single Stellar Population (SSP) results from different authors.

The current database includes SSP models as well as atmosphere libraries that can be used in SSP computations, and it is expected to be fully operative at the end of summer 2007. The following SSP models and atmosphere libraries have been included with the previous explicit authorization of the authors: *S. Bressan*: Silva et al. (1998); *G. Bruzual*: Bruzual & Charlot (2003); *E. Bertone*: Rodríguez-Merino et al. (2005); *A. Buzzoni*: Buzzoni (1989); *M. Cerviño*: Cerviño et al. (2002), González Delgado et al. (2005), Cerviño & Luridiana (2006); *U. Fritze-v. Alvensleben*: Kurth et al. (1999), *M.L. García Vargas*: García-Vargas et al. (1995); *M.R. González Delgado*: Martins et al. (2005); *C. Leitherer*: Leitherer et al. (1999), *C. Maraston*: Maraston (1998);

[1]With the only exception of PEGASE-HR and PGos3 database at `http://vo.obspm.fr/cgi-bin/siap/pegasehr.pl` and `http://ov.inaoep.mx/pgos3` respectively.

Ph. Prugniel: Fioc & Rocca-Volmerange (1997), Le Borgne et al. (2004), *L. Smith*: Smith et al. (2002), *A. Vazdekis*: Vazdekis (1999). The database also includes the results of surface brightness fluctuations, which can be used as a *metric of fitting* for galaxy population studies (see Cerviño & Luridiana contribution in these proceedings). A co-authored paper with model comparisons by means of VO facilities is expected during 2008.

The sort goal of the project was to explore the best way of include and use theoretical data in the VO. SSP models are optimal to this purpose since they are in the middle of the workflow that goes from stellar evolution theory to galaxy observations: an SSP model is the description of the spectral energy distribution of a system composed by stars and it is obtained by a suitable combination of stellar atmosphere models and evolutionary tracks (see Cerviño & Luridiana contribution in these proceedings). Hence, the description of a SSP result, besides the specific code used, can only be understood when the initial inputs are also known. In the real/VO world this knowledge can be only achieved by keeping track of nested references/VOTables in the paper/SSP-VOTable that describes the model result.

PGos3 has also been used for the development of the Theoretical Spectral Access Protocol (TSAP, see Rodrigo's et al. contribution in these proceedings) for theoretical synthesis models access. However, the large variety of synthesis models input parameters used by different authors leads to a complex and non homogeneous structure of the resulting database. As a result, TSAP is a valid protocol for retrieving a specific model but not for exploring and searching in a complex database. This issue can only be solved with a more general protocol that allows a recursive search defined by the service[2].

The final issue related to the implementation of theoretical models in the VO is to recover the corresponding credits of the models (and inputs) used (see Rodrigo's et al. talk in these proceedings). In the current version, bibliographic references are explicitly quoted in the VOTable header information. However, it is badly needed that VO applications recover such information in a user-friendly front-end.

The second term goal, besides the model comparison with VO tools quoted before, is to produce VO workflows. Currently we are working in three directions: (i) the inclusion of the VOTables of SSP models in codes designed for galaxy fitting like StarLight, (Cid Fernandes et al., 2005, see also Schonell's et al. contribution in these proceedings), (ii) the use of atmosphere libraries and isochrones (in VO compliant format) in SSP codes, and (iii) the use of SSP results as input of the photoionization code CLOUDY (Ferland et al., 1998), in coordination with G. Ferland.

[2] A similar situation happens with the access to VizieR by VO applications and its access via WWW.

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