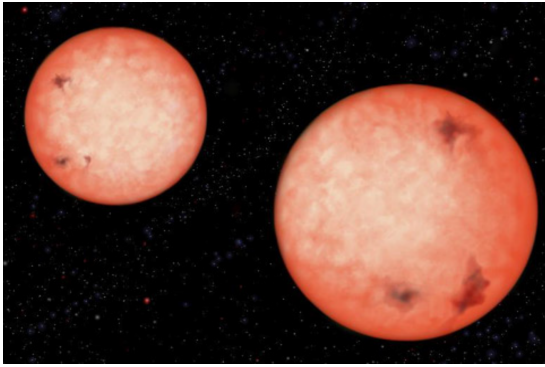


Searching for cool subdwarf binaries using VO tools



SUMMARY.

Multiplicity rates provide information of formation and evolution, and in particular, close binary systems provide with valuable information of the components physical properties (e.g. mass, radii etc) that, especially for faint objects, are difficult to get if isolated.

The project consists of searching for subdwarf companions through infrared excess using Virtual Observatory (VO) tools, such as VOSA, Aladin, and TOPCAT. Known binary systems will be used to study the viability of the method, with photometric data available in VO archives. The procedure will be applied to two different samples with low-mass, low-metallicity stars.

— OBJECTIVES —

Many multiplicity studies do not account for close binary systems due to the observational difficulties of finding them. This project will impact in the actual rates of multiplicity of low-mass low-metallicity objects, helping to discriminate between theories.

In the future, the identified systems will be followed up with different techniques, providing with estimation of mass and radii, fundamental for testing evolutionary and atmospheric models. Results will have an impact on the improvement of atmospheric and evolutionary models.

Cool subdwarfs could be defined as low-mass (i.e. low effective temperature) low-metallicity stars. Companions found around these objects are expected to also have a low metallicity. The student will:

- Search for companions through infrared excess in the stellar spectral energy distribution (SED) and perform different statistics to obtain multiplicity rates.
- Learn and apply VO tools, such as VOSA, Aladin, and TOPCAT. In particular, test the accuracy to detect binaries with similar atmospheric parameters with VOSA's binary fit.
- Improve and adapt an already existing Python code for the analysis.

— Centro de Astrobiología (CAB) —

The project will be developed at the “Centro de Astrobiología”, Villafranca Campus, which resides at ESAC site,

in Spain. The student will have the opportunity to interact with astrophysicists of the Spanish Virtual Observatory (SVO) team.

- Centro de Astrobiología (CAB / CSIC-INTA)
- CAB URL
- SVO URL
- Camino Bajo del Castillo s/n, Urb. Villafranca del Castillo, 28692, Villanueva de la Cañada, Madrid, Spain

— THEORY —

by MARI CRUZ GÁLVEZ-ORTIZ

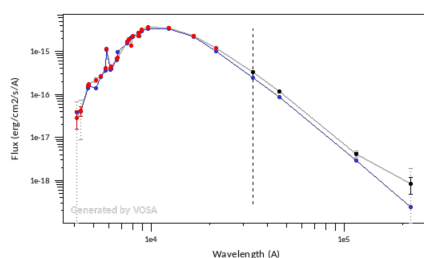
Introduction to statistical techniques and the study of low-mass, low-metallicity objects and their characteristics.

— APPLICATIONS —

by PATRICIA CRUZ

Review tutorials on VO tools and their application to known data sets, and binary systems.

Search for new subdwarf companions through IR excess from different data sets: i) a pre-selected list of low-metallicity objects; and ii) a list of Gaia sources.



Example of an IR excess with VOSA.

— MAIN PROGRESSION STEPS —

- Tier 1: Management of VO tools and databases
- Tier 2: Sample SED treatment and study, analysis and statistics
- Tier 3: Preparation of written project and presentation

— EVALUATION —

The evaluation will be based on a written report describing the whole project, followed by an oral presentation with a short summary for the SVO team at CAB.

- Theory grade [30%]
 - Comprehension of theoretical background as part of the written report.
- Practice grade [30%]
 - Project development, progress, analysis, and conclusions, as detailed in the report.
- Defense grade [40%]
 - Oral and slides quality
 - Context
 - Project / Personal work
 - Answers to questions

— BIBLIOGRAPHY & RESOURCES —

Tutorials on the VO tools that will be used in the project are available at:

- SVO tutorials at Zenodo

— CONTACT —

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