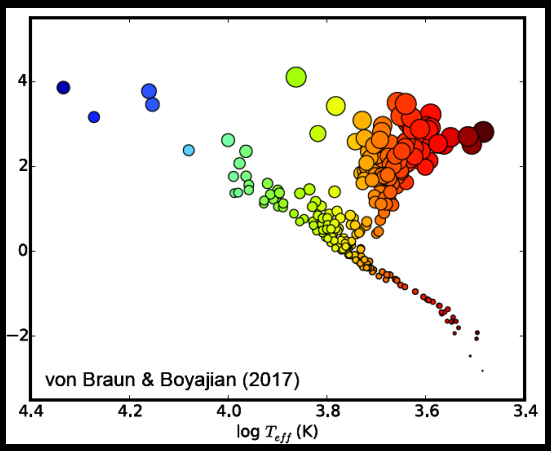
CHARA/SPICA: Limb darkening and binaries measurements



SUMMARY.

Within this METEOR, we propose to study two main programs of the CHARA/SPICA instrument in the field of stellar parameters. The first one is about the impact of the correct processing of the limb darkening of stars in the determination of the fundamental stellar parameters of star based on the future CHARA/SPICA interferometric measurements. The goal is to compute 1D and 3D models of stellar atmospheres and to study the possibility of defining simple and easy to extrapolate laws in the different regions of the HR diagram. The second program that is proposed is dedicated to the measurements of stellar masses thanks to the observation of binary stars.

OBJECTIVES

- The main objectives of this METEOR, through the detailed study of the astrophysical objectives and of the practical aspects of two main scientific programs of the future CHARA/SPICA instrument, are to permit the students to become familiar with the principles of determining fundamental stellar parameters, such as radius, effective temperature, mass of stars with interferometric measurements.
- They will learn practical information about stellar atmospheres modeling, stellar evolution models, and interferometric measurements.

PREREQUISITES

Courses linked/coming in support to this METEOR: Stellar Physics (in particular: stellar atmospheres and general principles of stellar evolution); Fourier optics (in particular for what concerns interferometric measurements); Numerical methods (if possible for a better handling of statistical and systematics errors in actual measurements, as well as fitting tools).

THEORY

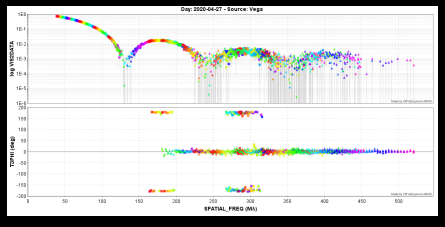
by Denis Mourard, Cyril Pannetier

Introduction to optical interferometry and the CHARA/SPICA instrument.
Introduction to stellar atmosphere modeling and its importance for the measurement of limb darkening of stars.
Introduction to binary measurements.

APPLICATIONS

by Denis Mourard, Cyril Pannetier

With the simulation tools already existing thanks to the JMMC (ASPRO2/LITpro/AMHRA) and the SPICA group (SNR calculator), we will study the possibility of interpreting CHARA/SPICA measurements (the plot presents a simulated observation of a star in terms of squared visibility and closure phase) through simple toy models or more elaborated ones, like stellar intensity profiles computed by 1D or 3D models. We will also study in details the possible range in magnitude and separation for binary measurements.



MAIN PROGRESSION STEPS

For instance :

- First fourth of the period : 3 courses and personal study of three articles.
- Second fourth of the period : Bibliographic study and preparation of a scientific program like for a time proposal.
- Second half of the period : numerical project.
- Last week : preparation of the final oral presentation.

EVALUATION

- Oral presentation related to the three articles in relation to the 3 courses
- Oral presentation of the time proposal
- Permanent evaluation during the numerical project
- Final evaluation during the global oral presentation.

BIBLIOGRAPHY & RESSOURCES

https://lagrange.oca.eu/fr/spica-project-overview
http://www.jmmc.fr/

CONTACT

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