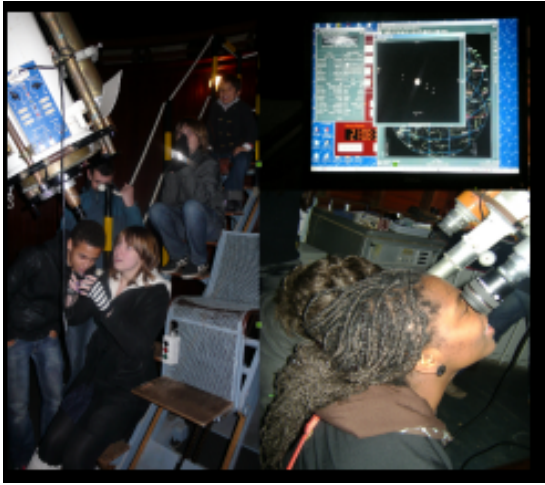


# Stellar Pulsation and Evolution Polar and Space Missions



## SUMMARY.

*Stellar Pulsation and Evolution –SPE– based on Polar and Space Missions, gives rise to two interesting stellar physics fields, (1) the theory of the pulsation and evolution of various stellar classes accross Hertzsprung–Russell diagram towards an understanding of the origin of the Universe, and (2) the observation and data analysis techniques, such as Astrometry, Photometry and Spectroscopy from Polar and Space Telescopes. The theoretical topics are shared among stellar interiors and atmosphere structure, stellar energy and transport mechanisms, and mechanisms of the pulsation and the hydrodynamical phenomena induced by shock waves. Whereas, the application themes are founded on frequency detections, mode identification, stellar parameters determination, and time–series data interpretation from light and Radial Velocity Curves.*

## — OBJECTIVES —

- This Meteor provides students with the knowledge and research ability for a career in Astronomy towards an improving the research development for new generations.
- The students learn how to relate stellar models to observable quantities by use of observation and theoretical methods, and they will be able to deal with the Stellar Evolution and Structure challenges.

## — PREREQUISITES —

Uncomment the Fundamental Courses that are required for your METEOR.

- ☒ S1. Fourier Optics
- ☒ S1. Data Sciences
- ☒ S1. Numerical methods
- ☒ S2. Stellar physics

## — THEORY —

by MERIEME CHADID

The theoretical goal is to provide a background in stellar physics specially in pulsation and evolution. After a recapitulation of the observational properties of stars, the physical conditions in stellar interiors and atmosphere are taught, in particular the usual conservation equations of stars in general. Then, nuclear sources of the

stellar radiation and the energy transport are studied with driving mechanisms of the pulsation and hydrodynamical phenomena induced by shock waves. The stellar evolution is studied by the use of the simple analytical models, and the equations of stellar pulsation is derived for radial and non radial pulsations.

## — APPLICATIONS —

by MERIEME CHADID

The application field is based on mode detections, frequency analysis and stellar parameters determination by the use of ground–based observations, time–serie Antarctica observations (PAIX) and Space Telescopes (CoRoT, KEPLER, GAIA and PLATO). The student will learn and experiment the observation techniques by use of Polar and Space Telescopes with various optical instruments.

Use the following code to insert a figure



PAIX Polar Antarctica Telescope  
@Chadid

## — MAIN PROGRESSION STEPS —

The students will progressively get deeper insight on the main properties of stars by first deriving simple models and by further performing experiments with observing runs and data analysis algorithms.

## — EVALUATION —

Oral presentation (50%) and a global mark from the supervisor (50%) to evaluate the student on the Objectives described above.

## — BIBLIOGRAPHY & RESOURCES —

- Communiqué de presse
- Asteroseismology C. Aerts, J. Christensen and Kurtz 2010
- HDR Stellar Pulsation and Evolution, M. Chadid 2014
- An introduction to stellar astrophysics, F. Leblanc Willey 2010
- Stellar Structure and Evolution R. Kippenhahn and A. Weigert 2012

## — CONTACT —

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