Eric Nuss and Bertrand Plez
LUPM, CNRS/IN2P3 - UMR 5299
University of Montpellier
Place Eugène Bataillon - CC 72
34095 Montpellier Cedex 05 France

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Students are encouraged to apply for a PhD fellowship, starting October 1st 2021, in our Astrophysics and Cosmology group:

“Preparation to the cosmological analyses with the Legacy Survey of Space and Time (LSST) : characterization of the terrestrial atmospheric absorption”

The application deadline is **June 1st 2021.**
Please send application material to:
eric.nuss@umontpellier.fr and bertrand.plez@umontpellier.fr.

- Location: Astro-particles, Astrophysics and Cosmology group at LUPM, Montpellier University, France.
- Salary: 1715€/month (including health insurance, employment insurance …).
- Starting October 1st, 2021, or as soon as possible after this date.
- Duration: 3 years, standard duration for a french PhD.

Key Requirements:
The successful applicant:

- will hold a masters degree (or equivalent) in physics with knowledge in the related field of research: detector physics, astrophysics, cosmology, astro-particle physics, ...
- will have experience in data acquisition and analysis, and programming as python, C++, ...
- should also have excellent English or French written and oral skills,
- as well as good team-working abilities.

Additional qualifications:

- experience with Linux operating systems,
- experience working with laboratory equipment and electronics, data acquisition,
- experience with statistical analysis of large data set.

Why should you apply?

- working in an international, creative and highly motivated environment,
- cutting-edge research topics with high application potential,
- Working in a multidisciplinary research team,
- with a stimulating and friendly supervising and mentoring environment,
- unique research facilities,
- training and development possibilities (seminars, workshops, conferences, ...),
- software and physics skills training.

Application:
Please include the following information with your application:

- contact details and personal data,
- copy of the highest degree,
- language skills,
- contact details for 2 or 3 references. Your academic referees should send us recommendation letters directly via email.

In addition, please include the following documents:

- cover letter describing your motivation and interest for the project,
- Curriculum, including degrees and other completed courses, work experience

Responsibilities:

- assembling, testing, characterizing and operating an experimental setup for testing infrared cameras for astrophysics,
- data and image analysis,
- atmospheric modelling and correlation between thermal infrared sky measurements and stellar optical photometry,
- cooperation with other research institutions on developing a subsystem for the photometric calibration of the LSST, taking part in data acquisition and analysis,
- publication of scientific papers, presenting their work at international meetings, workshops and conferences, visits and collaboration with other institutions, taking part in writing reports.

Title: “Preparation to the cosmological analyses with the Legacy Survey of Space and Time (LSST) : characterization of the terrestrial atmospheric absorption”

Project description, context and motivation:

The Vera Rubin Observatory will survey the southern sky every 3 nights for 10 years, starting 2021 [1,2,3] . A large number of supernovae will be discovered out to large distances, allowing the characterization of dark energy. This is a major goal of modern cosmology, however challenged by the need to perform precision photometry at the 0.1% level. Our group at LUPM has been working for 5 years on trying to improve this precision, with collaborators in Paris (LPNHE, LAL), and Marseille (CPPM, and OHP [4]). A team from Harvard (USA) recently joined our efforts.

The “StarDice” experiment [5] consists of a very stable laboratory light source (led point sources), which is observed with the same telescope that acquires photometry of standard stars (Calspec sample, [6]). This allows to very precisely calibrate the astrophysical fluxes on laboratory standards. The current photometric precision of the Calspec stars is around 1%, limited by theoretical models of the fluxes of white dwarfs observed with the Hubble Space Telescope. Our prototype “StarDice” could show in 2019 that we can reach this 1% accuracy independently of stellar models [7,8]. It also allowed us to determine that we cannot progress without a better characterization of the terrestrial atmospheric transmission, both vertical and horizontal. This is therefore the main topic of this PhD project: use various IR and visible instruments to measure the atmospheric extinction, coupled to remote sensing (T, P, aerosols, …), and models of the terrestrial atmosphere. The goal is to improve our stellar photometric measurements with a factor of 5 to 10. This will have a major impact on the scientific return of the LSST in cosmology, as well as in other fields, e.g. stellar physics.

Bibliography:

[1] https://www.lsst.org/
[2] https://arxiv.org/abs/0805.2366
[3] https://arxiv.org/abs/0912.0201
[4] http://www.obs-hp.fr/welcome.shtml
[5] N. Regnault et al., A&A 581, A45, 2015
[6] R.C. Bohlin et al., AJ 158, 211, 2019
[7] M. Betoule et al., https://astronomy2018.univie.ac.at/abstractsFM12/#FM12abstr10
[8] F.Hazenberg PhD thesis (in French), "Calibration photométrique des supernovae de type Ia pour la caractérisation de l’énergie noire avec l’expérience StarDICE" : http://www.theses.fr/2019SORUS142

E. Nuss and B.Plez
Professors at Montpellier University

Phone: (33) 4 67 14 41 91
emails : eric.nuss@umontpellier.fr , bertrand.plez@umontpellier.fr