

Proposition de stage de M2 Recherche
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Subject: Searching for young stars in large astronomical surveys

Summary: The Vera Rubin Observatory Legacy Survey of Space and Time¹ (LSST), expected to begin operations in 2022, will produce a larger and more complex data set than any of its predecessors. The survey will produce an image of the entire southern sky every few days during 10 years, allowing us to study in detail the transient sky (astronomical objects whose brightness changes as a function of time). At each night, the LSST is expected to detect 10 million transient candidates which need to be classified before they can be used to produce scientific results. In this new big data environment, old methods for analyzing the data cannot be used. It is necessary to employ the modern automatic machine learning techniques which can help the researcher to separate scientifically interesting candidates.

In France, we are currently building the infrastructure which will allow us to perform this task. The Fink broker² is a software environment able to digest the large number of candidates produced by LSST and designed to identify interesting objects. However, the definition of what is interesting changes depending on the scientific interest of each researcher. Fink's infrastructure enables each user to build their own filter and identify, within the sea of data coming out of LSST, what are the candidates which fulfill their personal scientific interests. Many times such filters are based on state of the art machine learning techniques.

The goal of this project is to prepare the first stages of a science module for Fink, that will focus for young stellar objects exhibiting periods of low brightness during their life-time. The study of young stars is important to help us understand the theory of stellar evolution and star formation. We will use data from the on-going Zwicky Transient Facility (ZTF) alert stream in order to prepare a search module that will be able to identify these peculiar objects and help direct them to the broad astronomical community. This work will be done on real data from the start, in collaboration with researchers at LPC and at IJCLab (Orsay). It includes astronomy, statistics, programming and machine learning tasks. The student will also interact with members from the Cosmostatistics Initiative³ (COIN).

The successful candidate should be willing to work in an interdisciplinary team, willing to learn new things in a active research environment, comfortable with programming in Python and with basic statistics tools. Familiarity with collaborative code development, e.g., github is welcome. All the activities and discussions related to the work will happen in English. An interest in stellar astrophysics and curiosity for the subject are also important.

¹ <https://www.lsst.org/lsst/>

² <https://fink-broker.org/>

³ <https://cosmostatistics-initiative.org/>