ÉCOLE POLYTECHNIQUE
UNIVERSITÉ PARIS-SACLAY

INTERNSHIP PROGRAM FOR INTERNATIONAL STUDENTS

INTERNSHIP SUBJECT FORM

Name of the Host Laboratory	LULI
Website of the Host Laboratory	
Research Group	TIPS
Internship Supervisor	Caterina Riconda
Internship Subject	**Optimization of pair production using vortex beams**
Student's level	☐ Advanced Undergraduate Students (3rd or 4th year) x☐ Master's students (1st or 2nd year) x☐PhD students
Proposed Duration	☐ 3 months x☐ 4 months x☐ 5 months x☐ 6 months
Prerequisites	A mastering of classical electrodynamics is necessary and some prior knowledge of quantum electrodynamics welcome but not mandatory. Knowing Python will prove necessary to use the ssimulation code SMILEI but can be learned during the traineeship.
Internship description (max. 15 lines)	Recently, it was highlighted that vortex beams, and Laguerre-Gauss (LG) beams in particular, carry large values of orbital angular momentum (OAM).*The proposed internship aims at investigating electron-positron pair production driven by OAM vortex beams, as well as generation of sources of high-energy photons (gamma rays).* The mechanism behind pair production is the so-called Breit-Wheeler process in which a gamma-photon (emitted by a radiating ultra-relativistic electron) collides with the strong laser field and produces a pair. Identifying the optimal regimes of interaction for abundant pair production using OAM vortex beam will be of outmost importance to prepare the future experiment at Apollon but also for our understanding of how angular momentum can be exchanged in between the incident laser pulse and the emitted gamma-photons and electron-positron pairs. The result of this study can have a variety of application in the laboratoy but also for the understading of basic phenomena in space : how there can be angular momentum transfer in astrophysical objects or how fast particles in the cosmic ray spectra can be accelerated by the interaction of pair plasma jets. The study will be conducted by the trainee in the theory and simulation group of LULI. The core of the intership will be performing extensive 3D Particle-In-Cell (PIC) simulation using the new, open-source and collaborative PIC code SMILEI, the work will also require some theoretical modelling,
