

MI INTERNSHIP PROPOSAL

(One page maximum)

Laboratory name: LAPTh, Laboratoire d'Annecy-le-Vieux de Physique Théorique

CNRS identification code: UMR 5108

Internship director'surname: Piotr Tourkine

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Web page:

Internship location: LAPTh, Annecy, France

Phone number:

Thesis possibility after internship: N/A

Funding: YES

If YES, which type of funding: standard internship funding

Title: Quantum consistency of String interactions.

Summary (half a page maximum)

In this **MI internship**, the intern will revisit a problem as old as string theory itself: the quantum mechanical consistency of interactions between fundamental strings. More precisely, the intern will study the quantum mechanical scattering amplitude at the first order in perturbation theory. It is famously given by the Veneziano formula, derived in the 60s. While it has been known since the 70s that String Theory is consistent quantum mechanically (the no-ghost theorem), it has never been shown directly that the Veneziano formula respects the unitary evolution of quantum mechanics. Recently, it has been observed empirically that the Veneziano formula obeys a remarkable property, stronger than unitarity [1]. The intern will work on a mathematical proof of this property.

In practice, this will amount to literally looking at the properties of the poles of the Euler beta function. As surprising as it may sound, more than 2 centuries after Euler, there are still simple things to understand about this object which can in addition tell us something new about string theory.

Additional info: The student would belong to the group of the internship director Piotr Tourkine and interact mostly with him. They could also interact with the rest of the group (postdocs, students), take part in our weekly activities such as seminars and journal clubs, and would also have the possibility to come along to CERN occasionally for our weekly visit to the Theory department, where the internship director have strong scientific ties.

[1] Eckner, Figueroa, Tourkine 2024, <https://arxiv.org/abs/2401.08736>

Please, indicate which speciality(ies) seem(s) to be more adapted to the subject:

Condensed Matter Physics: NO

Soft Matter and Biological Physics: NO

Quantum Physics: NO

Theoretical Physics: YES