March 14, 2025

Dear Amsterdam String Theory Group,

My name is Rafael Cordoba. I'm a second-year master student at the École Normale Supérieure (ENS) in Paris, France, on a theoretical physics degree. I write to you because I am interested in applying to the PhD position in your group. Having experience with Conformal Field Theory, Topological Quantum Field Theory and, the Algebraic formalism of Quantum Field Theory I believe make me an excellent candidate for this position and I am sure the string theory group will be a great place to start my academic career. In the following paragraphs, I will describe my interests in the position and relevant experience. Detailed information of my background, interests, and future projects can be found attached in my research statement or CV.

In general, I am very interested in the study of conformal field theory and the role symmetries play in quantum field theory and gravity. I started to study CFTs at the ICTP in Trieste, Italy, where, under the supervision of Professor Agnese Bissi, I got fascinated about the power of symmetries on CFT and the strong requirements they impose, in other worse, the (conformal) bootstrap, and I have been studied them ever since incorporating modern tools of bootstrap, extended operators and, symmetries.

Indeed, at the ICTP I studied the conformal bootstrap of holographic conformal field theories and how the introduction of a boundary (a extended object) constraint the crossing equation and therefore, it's spectrum. This was a cute introduction for me to the realm of generalized symmetries, CFTs and holography. Finishing my ICTP diploma in High Energy, I joined the ENS master's program where I have also started some projects revolving around CFTs, extended operators and bootstrap.

These include projects under the guidance of Professors Miguel Paulos, into the study of conformal defects and monotonic quantities along RG flows, under the guidance of Yifei He on her project "Bootstrapping Gauge Theories" where we have found the full non-perturbative S-matrix of pion-pion scattering and some other computational projects. Detailed information of interests and projects can be found in the research statement.

Additionally to those topics, I am interested on the application of CFTs to gravity where, in addition to the fascinating projects I have studied during my master and, my course work at the ENS (classes I am taking include 2d CFTs, string theory, AdS/CFTs and, Teichmuller theory) , I have came to understand the power of CFTs and symmetries and I am eager to explore them in my PhD . For instance, the study of rational CFTs being one of the first examples of fusion categories, Teichmuller theory and chiral operator algebras due to Moore and Seiberg, their connection to topological quantum field theory and manifold invariants due to Witten and, on the AdS/CFTs correspondence due to Maldacena to mention a few.

Finally, to stay updated on the latest developments in CFTs, generalized symmetries, and their applications to gravity, I have actively participated in various summer schools, journal clubs, and seminars. Some of them include the IHES summer school on symmetries and anomalies where I had the opportunity to learn more about generalized symmetries and their application to high energy physics and mathematics, the 2024 ICTP spring school on Super String Theory, and the Miguel Paulos and Yifei He's bootstrap journal club.

Therefore, I am very passionate about contributing original insights and exploring the potential of modern non-perturbative techniques on quantum field theory and string theory in which I look forward collaborate and learn from the group expertise. If you find this information relevant, please do not hesitate to contact me. Beyond discussing the position, I would be eager to learn more about the group's collaborations and, current and future projects. In the meantime, I attached is my CV with details

about my scholarships, awards, and academic trajectory. If you require any additional information, let me know, and I will be happy to provide them.

Thank you very much for considering my application.

Sincerely,

Rafael F. Cordoba L.