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Recommendation letter for **Axel Orgogozo**

Axel Orgogozo is my Ph.D. student, now at the beginning of the third and last year of his thesis work. With this letter I strongly recommend him for a postdoctoral position in high-energy physics phenomenology.

Axel's first research project concerned electroweak precision tests in *Higgsless* models. Unfortunately for us, the first evidence for the Higgs boson surfaced at the LHC a month after we put our paper out. However this project did allow Axel to master the effective field theory techniques in presence of a spontaneously broken global symmetry (CCWZ) and the approximate ways to deal with strong sector resonances (Vector Meson Dominance). He also learned how to control strongly interacting scale invariant theories via the OPE.

All this knowledge turned out quite useful in our second project, where we computed the S parameter in models with a light *composite* Higgs boson. Our goal was to find a generalization of the Peskin-Takeuchi dispersion relation formula from the Higgsless case to the case when a light Standard Model-like Higgs boson is present in the spectrum. In composite pseudo-Goldstone Higgs models, the Higgs couplings to all SM particles, and in particular to WW and ZZ, somewhat deviate from the SM values. This induces an IR-log contribution to the S (and T) parameters. Then there is a UV contribution due to resonances. In prior work these two were just put together and a log was cut off by the resonance mass. We instead carefully evaluated a matching term, eliminating any cutoff ambiguity.

In between working on T and S, Axel also studied the QCD uncertainties in the WW fusion at high energies, associated with the forward jet tagging efficiency. This has not lead to a publication, but it did allow him to acquire basic knowledge of Pythia and Monte-Carlo physics.

I am very happy with how Axel's PhD proceeded so far. To both our papers he contributed in a decisive measure. In the first paper he was responsible for computing resonance contributions to the T parameter, the only tough calculation in that paper, and for the comparison with the data. Once our paper appeared, Jernej Kamenik and Oscar Cata, who published a related calculation, claimed that we made a mistake, but after many email exchanges and checking they agreed that the mistake was theirs while Axel's calculation was correct. For our second paper Axel recomputed from scratch the SM Higgs mass dependence of S,T,U (including the finite terms). He also computed the matching term I mentioned above, and did all the Vector Meson Dominance phenomenology.

Spending his third PhD year at CERN will surely help Axel to broaden his horizons. Right now I would characterize his phase of development as being ready to take off. When I was an Assistant Professor at the Scuola Normale at Pisa, I supervised Brando Bellazzini and Roberto Franceschini, who were both in the same "ready to take off" phase at the end of their Ph.D. Axel holds at least the same potential as Brando and Roberto have subsequently realized. Axel's thorough and thoughtful way of approaching science also reminds me of Paolo Lodone.

In addition to caring deeply about physics (he once told me that he does not imagine doing anything else in his life), Axel has a nice and easy-going character, coming from the Basque country in the south of France. I am sure he will be an excellent addition to your group.

Sincerely,

Slava Rychkov

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