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The Great Beyond at the Exascale: Dynamical Simulations of the Frezzotti-Rossi model

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We give a very short outlook on the computational aspects of dynamical simulations for the study of the Frezzotti-Rossi model of elementary particle mass generation. Having recently demonstrated via lattice simulations that the non-perturbative mechanism exists, we now plan to investigate the compelling theoretical case that within this framework, we will be able to relate all elementary particle masses to a unique energy scale. More concretely, we hope to relate the Higgs mass to the W and/or top quark masses and further, to predict with 20-30% accuracy the scale of new physics to guide future experimental efforts, all without the shortcomings of technicolor and other composite Higgs models.

We expect that the simulations required to achieve these goals will be about an order of magnitude more complex and expensive than current state of the art lattice QCD simulations, but we have a roadmap involving quenched and partially quenched setups to proceed via several milestones to our final set of dynamical ensembles, which will certainly require Exascale supercomputing resources and a plethora of algorithmic innovations.

If we succeed, this will be the first time since Wilson that lattice field theory would be a tool driving discovery and not "merely" a computational approach for non-perturbative aspects of the Standard Model.

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