Excellence 0918								
RIF PROPOSAL NUMBER	**TITLE**	**COORDINATOR**	**HOST ORGANIZATION**	**PARTNER ORGANIZATION**	**FOREING ORGANIZATION**	**PROGECT BUDGET**	**RIF FUNDING**	**PUBLISHABLE SUMMARY**
EXCELLENCE/0918/0066	Quantum Fields on the Lattice	Haralambos Panagopoulos	University of Cyprus		FRO 1: Temple University FRO 2: University of Jena FRO 3: University of Pisa FRO 4: University of Edinburgh FRO 5: DESY German National Laboratory (Zeuthen)	€ 249,476.05	€ 249,476.00	This project lies in the area of the Physics of Strong Interactions, which govern the forces inside nuclei. In order to address a wide spectrum of important open questions within the project, we will strengthen our collaboration with a number of established international groups. Together with two postdoctoral fellows who will be hired for this purpose, our research group will reinforce its status as a center of excellence in this area of Physics. We will study in detail properties of hadronic states, which stem from their underlying theory: Quantum Chromodynamics (QCD). Methods of Quantum Field Theory will be used to investigate a number of observables, determined also through state-of-the-art numerical simulations on a spacetime lattice. Relating simulation data to experimentally measurable quantities requires a careful computation of renormalization factors induced by quantum effects. Our computations of renormalization factors will encompass a wide variety of improved discretizations of QCD, employed in large-scale simulations; thus our results will find immediate applications to the research of other international groups. As its first major goal, this project will calculate the renormalization of nonlocal operators which are widely used to extract spin, helicity and momentum distributions inside hadrons. A further direction regards Supersymmetric extensions of QCD, as a prototype for Beyond-the-Standard-Model Physics: Among many open questions in this direction are symmetry-breaking phase transitions, mixing of fields and composite operators, and the bound state spectrum. Another object of study is the QCD beta-function to 3 loops and for different improved lattice actions. Further, we aim to incorporate our techniques for calculating lattice Feynman diagrams into a user-friendly software package. Finally, we will continue our longstanding investigations of Quantum Field Theories in the vicinity of phase transitions, with particular emphasis on nonequilibrium dynamics of the quark-gluon plasma.