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Petascale Many Body Methods for Complex Correlated Systems

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Correlated systems constitute an important class of materials in modern condensed matter physics. Correlation among electrons are at the heart of all ordering phenomena and many intriguing novel aspects, such as quantum phase transitions or topological insulators, observed in a variety of compounds. Yet, theoretically describing these phenomena is still a formidable task, even if one restricts the models used to the smallest possible set of degrees of freedom. Here, modern computer architectures play an essential role, and the joint effort to devise efficient algorithms and implement them on state-of-the art hardware has become an extremely active field in condensed-matter research. To tackle this task single-handed is quite obviously not possible. The NSF-OISE funded PIRE collaboration "Graduate Education and Research in Petascale Many Body Methods for Complex Correlated Systems" is a successful initiative to bring together leading experts around the world to form a virtual international organization for addressing these emerging challenges and educate the next generation of computational condensed matter physicists. The collaboration includes research groups developing novel theoretical tools to reliably and systematically study correlated solids, experts in efficient computational algorithms needed to solve the emerging equations, and those able to use modern heterogeneous computer architectures to make then working tools for the growing community.