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# LSU Today Flagship Faculty: Mark Jarrell

(Source: LSU Today)

**Mark Jarrell**
*Professor*
*Center for Computation & Technology*
*Department of Physics and Astronomy*
*LSU College of Science*

**What was your previous position and where?**

I was a professor of physics at the University of Cincinnati.

**What brought you to LSU?**

LSU has a very strong effort in the study of correlated materials, with a group of roughly 15 faculty in physics and chemistry including experts in synthesis (3), characterization (8), computation (2) and theory (2).
What are your research interests?

My main area of interest lies in the physics of strongly correlated electronic materials which include many nanostructures, high Tc superconductors, and heavy Fermion and magnetic materials. These materials are characterized by one or more of the following phenomena: a Mott-Hubbard insulating phase, magnetism, non-Fermi liquid behavior or a very small Fermion degeneracy energy. In general, exact solutions of models of these systems are not possible, and attempts to use uncontrolled analytic techniques have met with limited success. However, in addition to the usual many-body techniques, I have developed techniques which separate the problem into strongly interacting and weakly interacting parts. The weakly interacting parts are treated with either perturbation theory or mean-field approaches, and then integrated out of the action. The remaining strongly interacting part of the action may be mapped to a small effective cluster problem which is treated with Quantum Monte Carlo, or QMC, or other non-perturbative approaches. I have also developed methods used to analytically continue QMC imaginary time results to real frequencies. This allows QMC simulations to address experiments such as reflectivity, photoemission, inelastic neutron scattering and transport.

**What do you hope to accomplish at LSU?**

I want to help build a strong effort in computational materials science, including correlated materials, materials for energy applications, bio-materials, etc. I am also interested in building stronger ties between the domain sciences and engineering and computer science and engineering and applied math.

**What do you enjoy most about LSU?**

The interdisciplinary research opportunities at the CCT.

**What are your major accomplishments?**

Contributions to the formalisms, algorithms and codes that drive computational materials science progress. These include the Maximum Entropy Method, Quantum Monte Carlo Methods, and Dynamical Mean Field Theory and its cluster extensions.

**Publish Date:**
10-19-2012



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