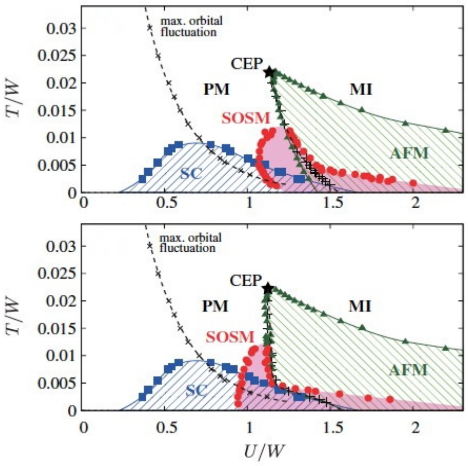
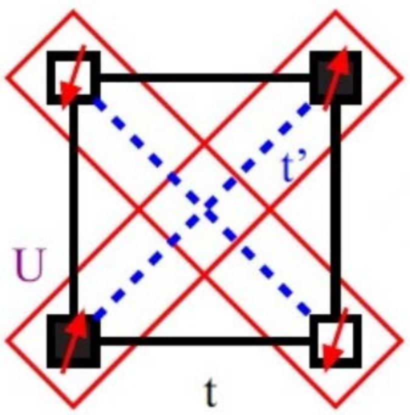
Some recent results



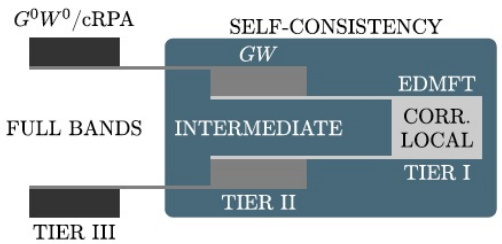
Spontaneous orbital selective Mott transitions were discovered in multiorbital Hubbard systems with negative Hund coupling. This unconventional symmetry-broken state, which can be viewed as odd-frequency orbital order, explains the "Jahn-Teller" metal phase of alkali-doped fullerides.

S. Hoshino and P. Werner, Phys. Rev. Lett. 118, 177002 (2017)



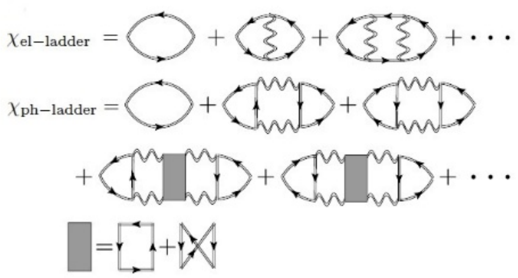
By introducing a suitable basis transformation, we showed that the physics of the two-dimensional Hubbard model can be connected to the spin-freezing crossover found in generic multi-orbital Hubbard systems. This provides a unified framework for discussing unconventional superconductivity in systems as diverse as cuprates, fulleride compounds and uranium based superconductors.

P. Werner, S. Hoshino, and H. Shinaoka, Phys. Rev. B 94, 245134 (2016)



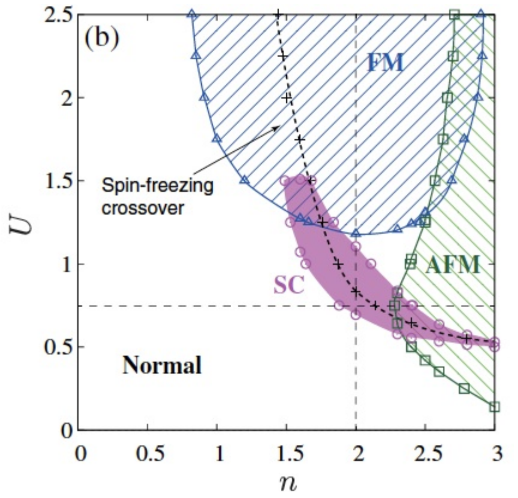
We realized the first self-consistent implementation of the GW+DMFT formalism. This method enables a parameter-free ab-initio simulation of weakly and strongly correlated materials.

L. Boehnke, F. Nilsson, F. Aryasetiawan, and P. Werner, Phys. Rev. B 94, 201106 (2016)



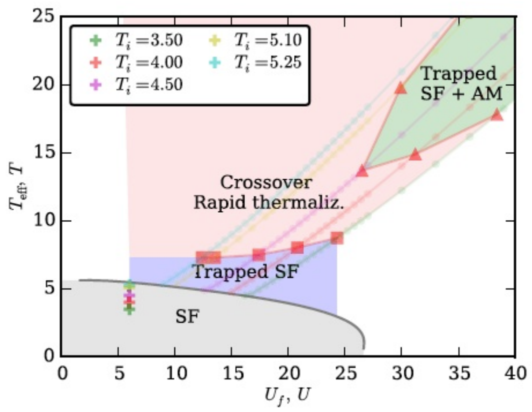
Laser-excitations of the superconducting Holstein model were shown to produce two distinct amplitude modes of the condensate: the usual "Higgs" amplitude mode and a second mode which involves a coupling to coherent phonon oscillations.

Y. Murakami et al., Phys. Rev. B 93, 094509 (2016)



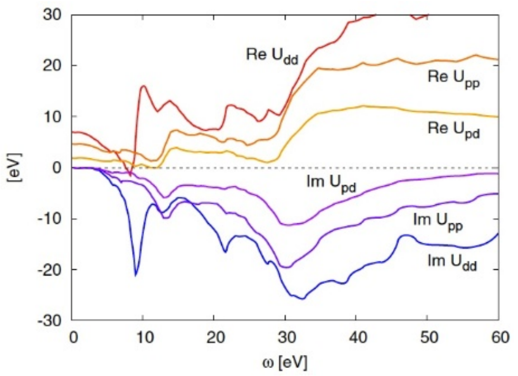
We discovered a new mechanism for unconventional superconductivity in multi-orbital systems: spin-triplet pairing induced by the strong local moment fluctuations in the spin-freezing crossover regime of Hund metals. This physics is relevant for strontium ruthenates and uranium based superconductors.

<u>**S. Hoshino and P. Werner, Phys. Rev. Lett. 115, 247001 (2015)**</u>



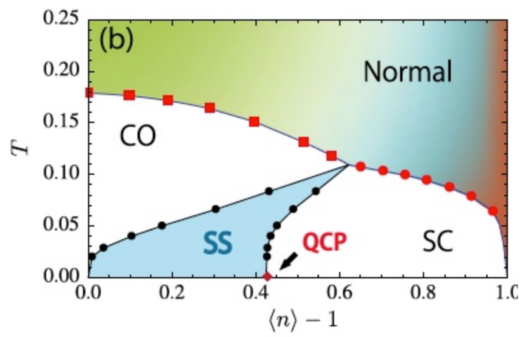
The bosonic version of dynamical mean field theory was generalized to nonequilibrium problems and used to study the different relaxation regimes of the Bose Hubbard model. The figure shows a "nonequilibrium phasediagram" for quenches out of the superfluid phase.

<u>**H. Strand, M. Eckstein and P. Werner, Phys. Rev. X 5, 011038 (2015)**</u>



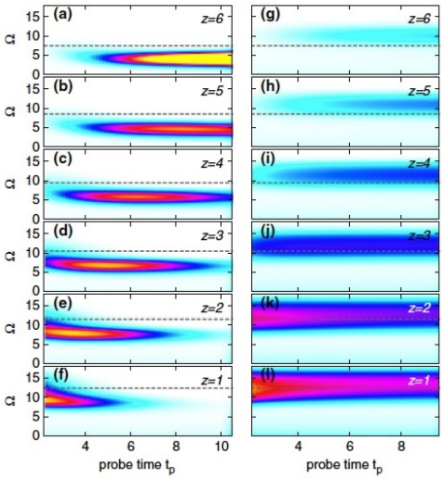
The dynamically screened interactions obtained from the constrained random phase approximation have been used in an ab-initio simulation of La2CuO4. In contrast to a static-U description, our simulation can reproduce the insulating nature of the material, as well as high-energy satellites of plasmonic origin.

<u>**P. Werner et al., Phys. Rev. B 91, 125142 (2015)**</u>



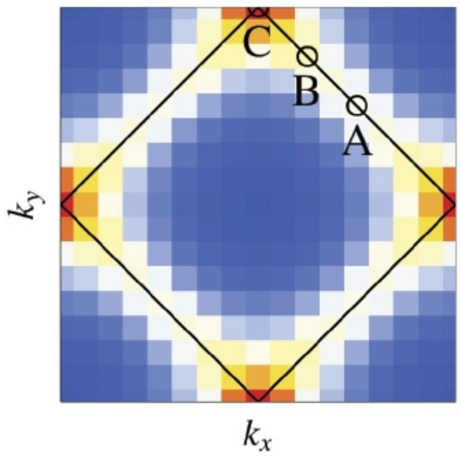
A supersolid phase with coexisting superconductivity and charge order was found in the Holstein model away from half-filling. At zero temperature, the transition into this supersolid state is marked by a quantum critical point.

<u>**Y. Murakami et al., Phys. Rev. Lett. 113, 266404 (2014)**</u>



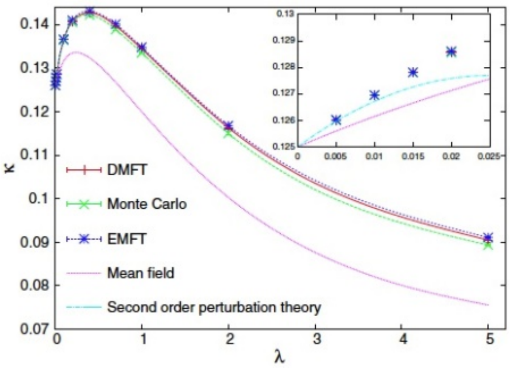
The very strong internal fields in polar heterostructures were shown to have a counterintuitive effect on the mobility of photoinjected charge carriers: the mobility is limited by the rate at which energy can be dissipated. Scattering with antiferromagnetically ordered spins provides a very efficient dissipation mechanism, which results in a high mobility in antiferromagnetic structures.

M. Eckstein and P. Werner, Phys. Rev. Lett. 113, 076405 (2014)



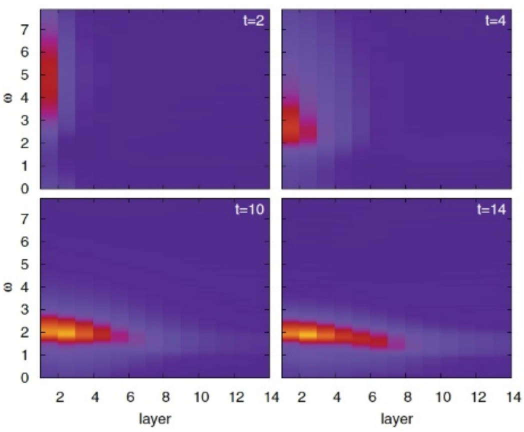
A cluster extension of nonequilibrium dynamical mean field theory was used to explore the effects of nonlocal correlations on the relaxation of the one- and two-dimensional Hubbard model. The method was benchmarked against time-dependent DMRG and perturbation theory in the weak-coupling regime.

N. Tsuji et al., Phys. Rev. B 90, 075117 (2014)



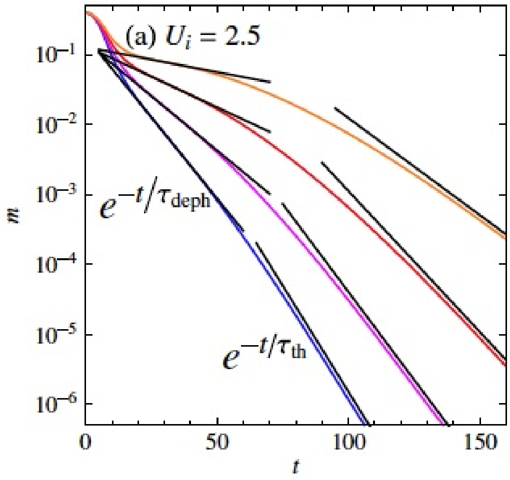
Together with colleagues from high-energy physics, we extended the dynamical mean field theory (and a simplified extended mean field approach) from condensed matter problems to quantum field theories.

O. Akerlund et al., Phys. Rev. D 88, 125006 (2013)



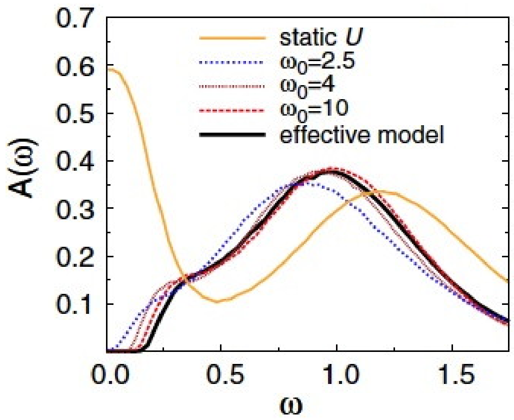
The inhomogeneous version of nonequilibrium dynamical mean field theory allows to study, among other things, the spreading of photo-excited doublons from the surface of a Mott insulator into the bulk. The figure shows time-resolved photoemission spectra of the upper Hubbard band.

M. Eckstein and P. Werner, Phys. Rev. B 88, 075135 (2013)



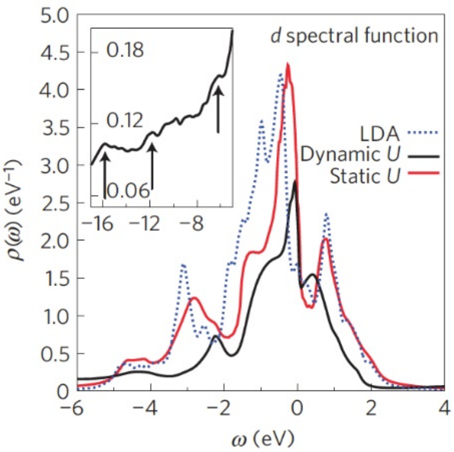
The analysis of a quench out of the antiferromagnetic phase of the Hubbard model revealed evidence for nonthermal critical behavior. The initial relaxation (dephasing) is controlled by a nonthermal fixed point, while the long-time relaxation is controlled by the thermal fixed point.

N. Tsuji, M. Eckstein, and P. Werner, Phys. Rev. Lett. 110, 136404 (2013)



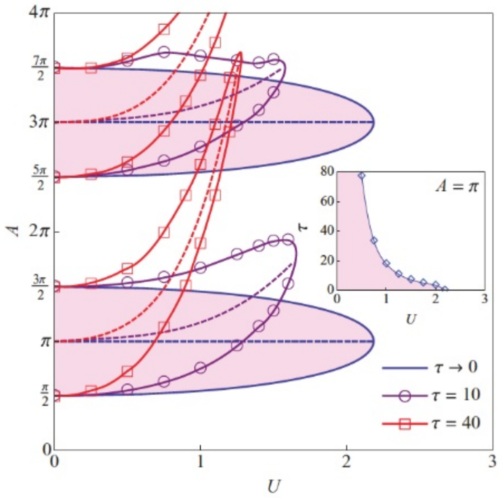
Low-energy theories for correlated materials typically involve dynamically screened interactions. We showed how to derive effective static models which incorporate the effect of high-energy screening.

M. Casula et al., Phys. Rev. Lett. 109, 126408 (2012)



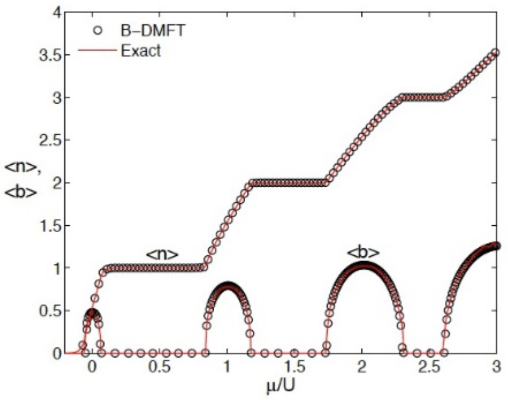
In collaboration with colleagues from France, Japan and the US, whe have studied the electronic structure of hole-doped BaFe2As2. We found that the metallic phase is a Hund-correlated metal, exhibiting strongly doping- and temperature dependent correlation effects.

P. Werner et al., Nature Physics 8, 331 (2012)



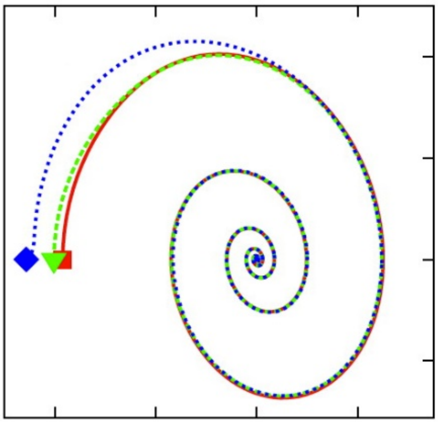
Weakly correlated metals may exhibit interesting effects in the presence of strong electric fields. For example, in a single-band system, the population can be inverted by the application of an asymmetric monocycle pulse. This inversion leads to an effectively attractive interaction between electrons.

N. Tsuji et al., Phys. Rev. B 85, 155124 (2012).



In collaboration with colleagues at ETH Zurich, we have developed a dynamical mean field formalism for bosonich lattice systems and obtained the solution for the Bose Hubbard model using a diagrammatic impurity solver.

P. Anders et al., New J. Phys. 13, 075013 (2011).



Electrons moving in a periodic band structure in response to strong electric fields exhibit Bloch oscillations, which are damped in a closed system due to heating. We found that above a critical interaction, the oscillations disappear completely, and the system establishes a linear relationship between current and energy.

M. Eckstein and P. Werner, Phys. Rev. Lett. 107, 186406 (2011).
