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Dual boson approach to collective excitations in correlated fermion system HARTMUT HAFERMANN, Institut de Physique Théorique (IPhT), CEA, CNRS, 91191 Gif-sur-Yvette, France, ERIK G.C.P. VAN LOON, Radboud University Nijmegen, Institute for Molecules and Materials, NL-6525 AJ Nijmegen, The Netherlands, ALEXEY N. RUBTSOV, Department of Physics, M.V. Lomonosov Moscow State University, 119991 Moscow, Russia, OLIVIER PARCOLLET, Institut de Physique Théorique (IPhT), CEA, CNRS, 91191 Gif-sur-Yvette, France, ALEXANDER I. LICHTENSTEIN, I. Institut für Theoretische Physik, Universität Hamburg, Jungiusstraße 9, D-20355 Hamburg, Germany, MIKHAIL. I. KATSNELSON, Radboud University Nijmegen, Institute for Molecules and Materials, NL-6525 AJ Nijmegen, The Netherlands — We describe the interaction between electrons and collective excitations in strongly correlated fermion systems by means of the so-called dual boson approach. It includes nonlocal corrections to extended dynamical mean-field theory (EDMFT) and is applicable to lattice fermion models with both short- and long-range interaction. We present results for the collective charge excitations in the (extended) Hubbard model and show that through the inclusion of vertex corrections to the polarization operator, the approach correctly describes the long wavelength collective excitations in the strong coupling regime. In particular, we find the zero sound mode when forces are short-ranged and plasmons in presence of a long-range interaction. We further examine the effects of nonlocal correlations in the extended Hubbard model and compute the phase diagram. Results are compared to EDMFT and the random phase approximation.

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