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DMFT analysis of the superconductivity in the Holstein-Hubbard model – Interplay of strong Coulomb interaction and electron-phonon coupling YUTA MURAKAMI, Department of Physics, University of Tokyo, PHILIPP WERNER, Department of Physics, University of Fribourg, NAOTO TSUJI, HIDEO AOKI, Department of Physics, University of Tokyo — Phonon-mediated superconductivity when, as in the alkali-doped fullerides and aromatic compounds, the Coulomb interaction, electron-phonon coupling and phonon frequencies are all comparable to the electronic band width poses an intriguing question. In order to obtain insights into the superconductivity in this regime, we have analyzed the Holstein-Hubbard model with the dynamical mean-field theory with a continuous-time quantum Monte Carlo impurity solver. We focus on the s-wave superconducting state when the Hubbard repulsion U, the phonon mediated attractive interaction λ and the phonon energy (ω_0) are comparable to the bandwidth. A particular interest is the effects of the retardation and the strong Coulomb interaction on the behavior of the transition temperature T_C, the superconductivity order parameter and gap in spectrum (Δ). We find that the Tc-dome against $U_{\rm eff} = U - \lambda$ significantly deviates from that in the anti-adiabatic limit, and that an effective model in the polaron representation reproduces the effect of the retardation and the Coulomb interaction well even for ω_0 smaller than the bandwidth. We also show an unusual isotope effect for fast phonons and deviation of $2\Delta/k_B T_C$ from BCS value.

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