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Quantifying the impact of plasmon and paramagnon effects in ”conventional” superconductors from the first principles

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The advances in the density functional theory for superconductors in the recent decade have paved a way to non-empirical calculation of superconducting transition temperature (Tc) of real materials. The theoretical extensions are also under way to include the effect of electronic dynamical charge and spin fluctuaions with no adjustable theoretical parameter, which can be a first step toward a unified first-principles treatment of superconductors–from the conventional phonon to unconventional electron mechanisms.

With our recent first-principles results, we exemplify how and how much the dynamical charge fluctuation (plasmon) and spin fluctuation (paramagnon) effects modify the Tc in the typical phonon-mediated superconductors, which have previously been discussed in semiempirical manners.

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