

# Super Fermi polaron and Nagaoka ferromagnetism in a two-dimensional square lattice

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We address the Fermi polaron physics of an impurity hopping around a two-dimensional square lattice and interacting with a sea of fermions at given filling factor. When the interaction is attractive, we find standard Fermi polaron quasiparticles, categorized as attractive polarons and repulsive polarons. When the interaction becomes repulsive, interestingly, we observe an unconventional highly-excited polaron quasiparticle, sharply peaked at the corner of the first Brillouin zone. This super Fermi polaron branch arises from the dressing of the impurity's motion with holes, instead of particles of fermions. We show that super Fermi polarons become increasingly well-defined with increasing impurity-fermion repulsions and might be considered as a precursor of Nagaoka ferromagnetism, which would appear at sufficiently large repulsions and at large filling factors. We also investigate the temperature-dependence of super Fermi polarons and find that they are thermally robust against the significant increase in temperature.

## References

H. Hu, J. Wang, X-J. Liu,  
Super Fermi polaron and Nagaoka ferromagnetism in a two-dimensional square lattice, arXiv:2312.00385

## Short bio (50 words) or link to website

<https://www.swinburne.edu.au/research/our-research/access-our-research/find-a-researcher-or-supervisor/researcher-profile/?id=xiajiliu>

## Relevant publications (optional)

## Career stage

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**Track Classification:** FINESS