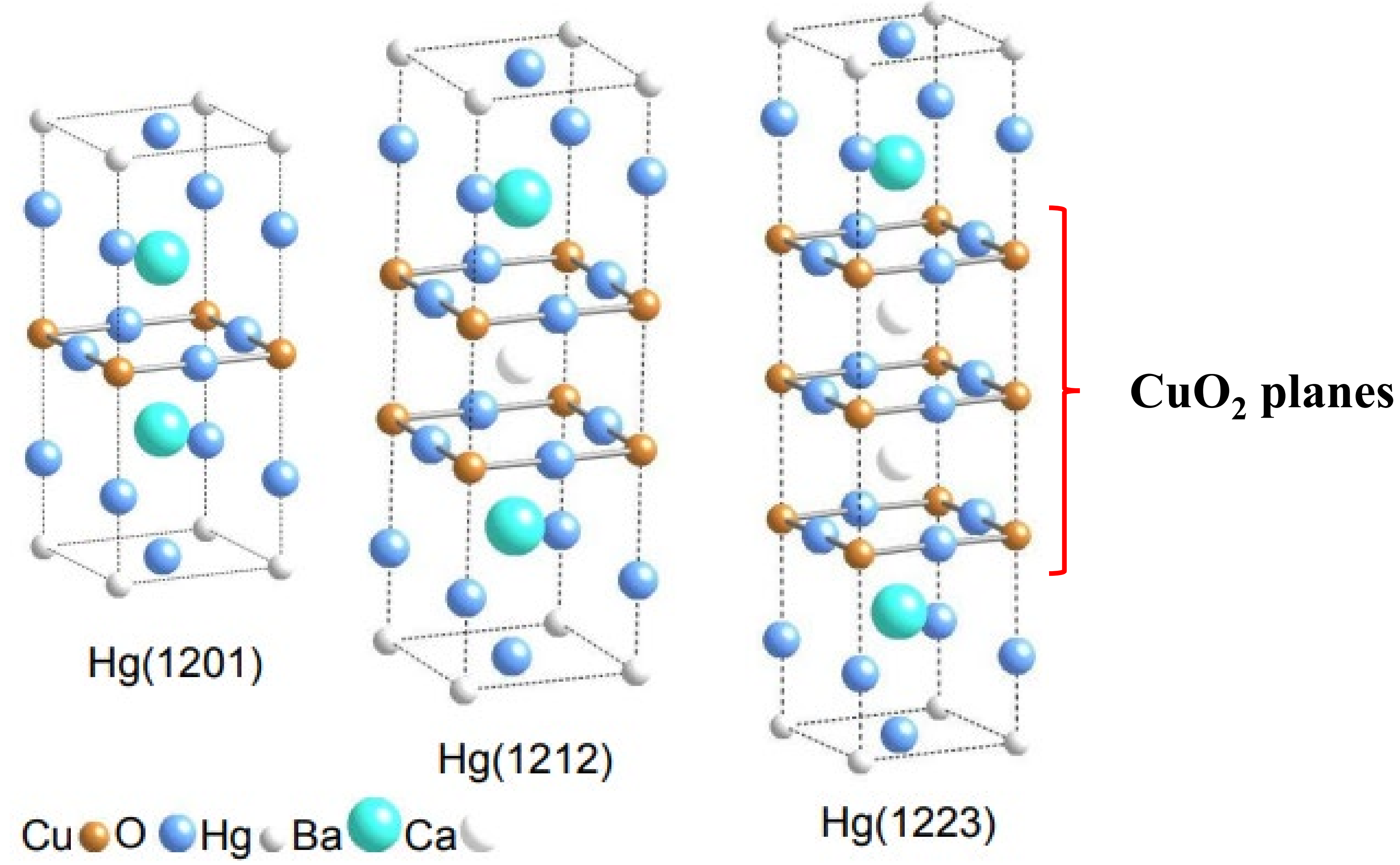
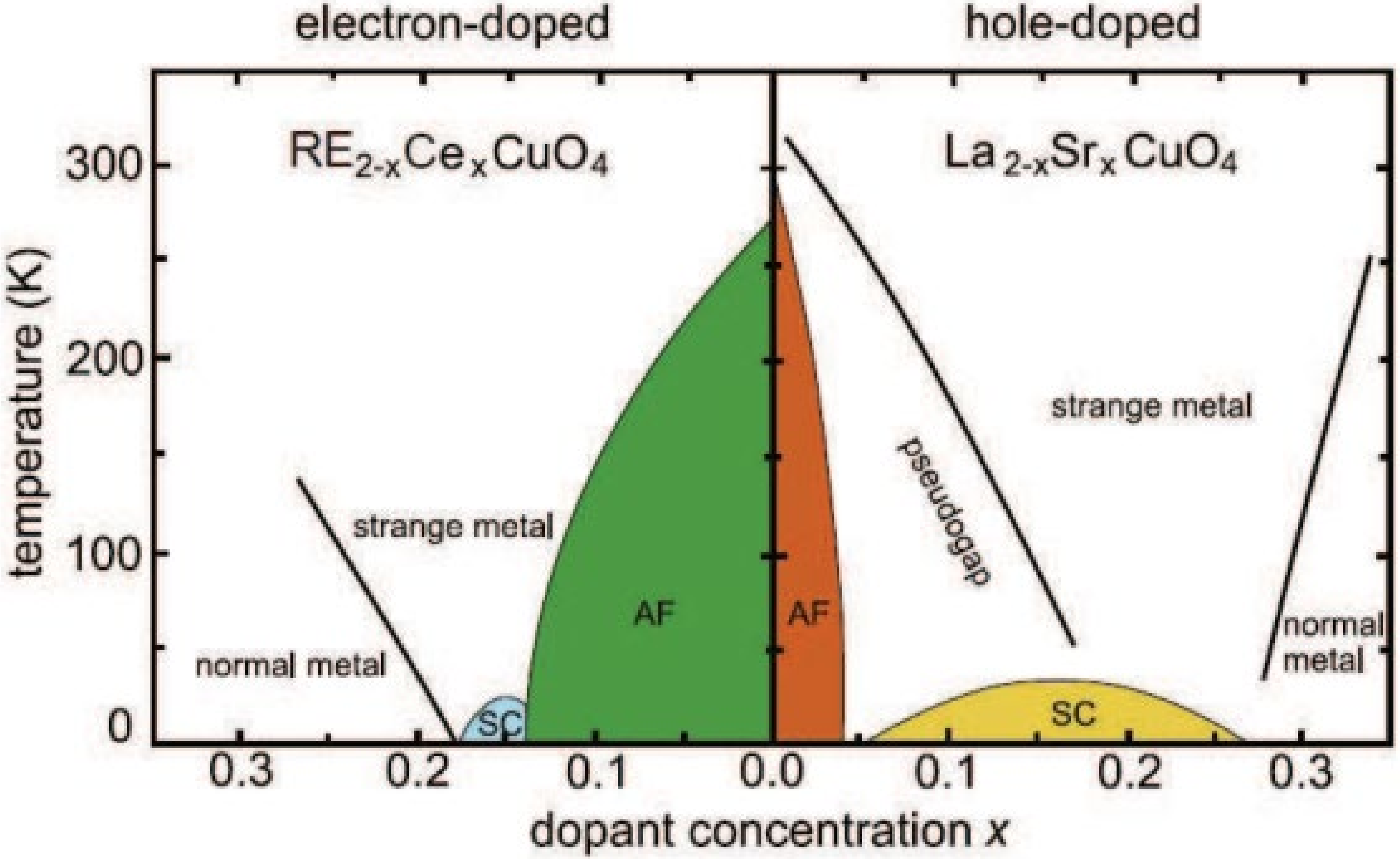
Cuprate Superconductor Crystal Structures



D. J. Scalapino, "A common thread: The pairing interaction for unconventional superconductors," Rev Mod Phys **84 (4), 1383-1417 (2012).**

Cuprate Superconductor Phase Diagram



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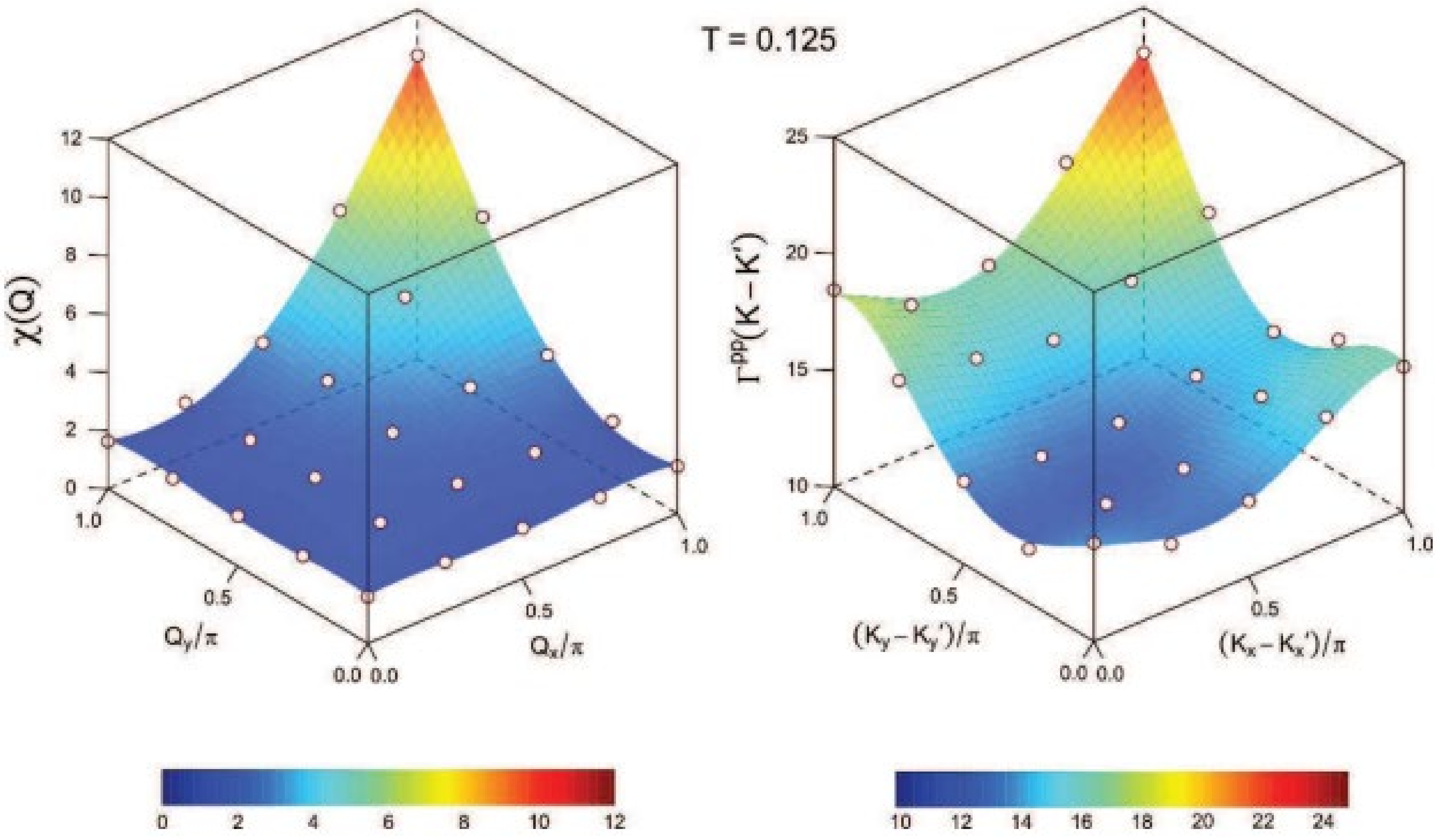
Cuprate Superconductor Spin Susceptibility and Pairing Interaction



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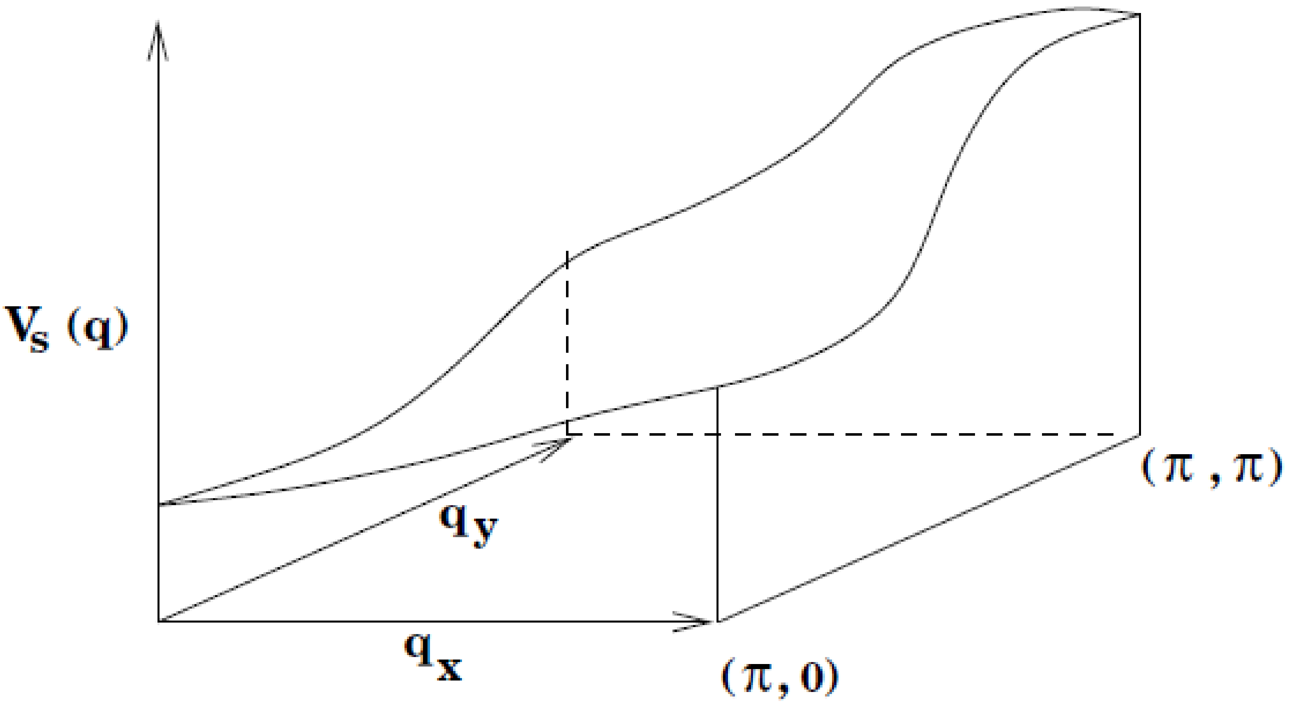
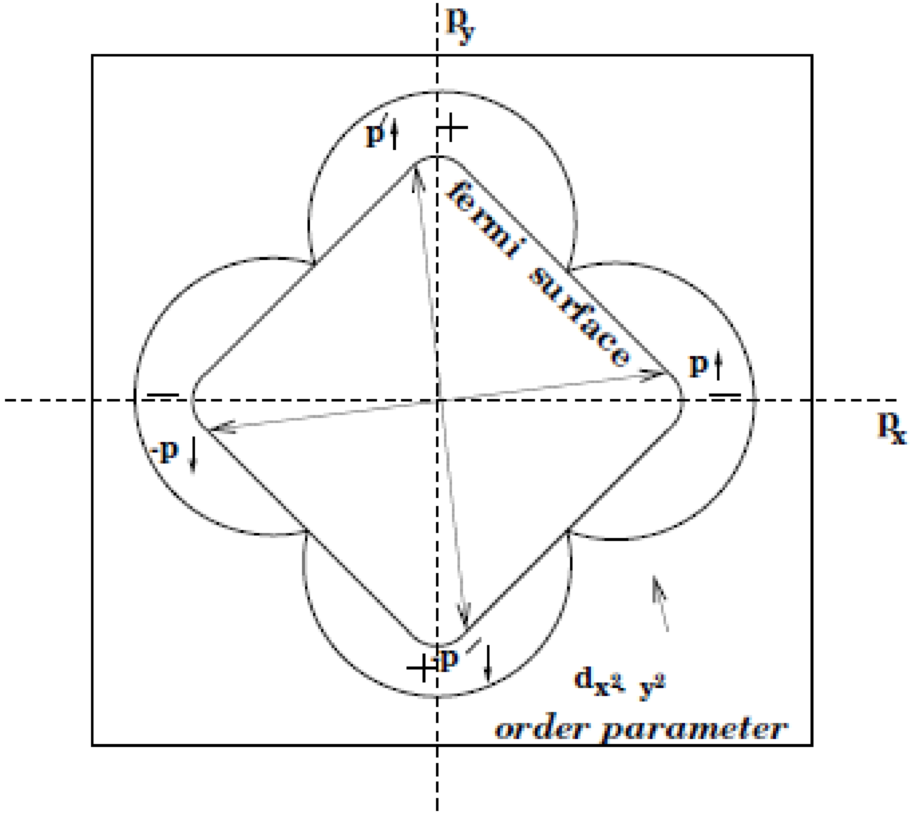


$$V_s(q,\omega) \cong \frac{3}{2}\,\frac{\bar{U}^2\chi_0(q,\omega)}{1-\bar{U}\chi_0(q,\omega)}$$

Fig. 4. Sketch of $V_s(q)$ versus q for a two-dimensional system with short-range antiferromagnetic spin fluctuations.

https://doi.org/10.48550/arXiv.cond-mat/9908287

Douglas J. Scalapino, "Superconductivity and Spin Fluctuations," J Low Temp Phys **117, 179-188 (1999).**



$$\Delta_p = -\sum_{p'} \frac{V(p-p')\Delta_{p'}}{2E_{p'}}.$$

Fig. 5. Illustration showing how a *d*-wave gap can provide a solution of the BCS gap eq. (5) for a pairing interaction which increases at large momentum transfer like the type illustrated in Fig. 4.

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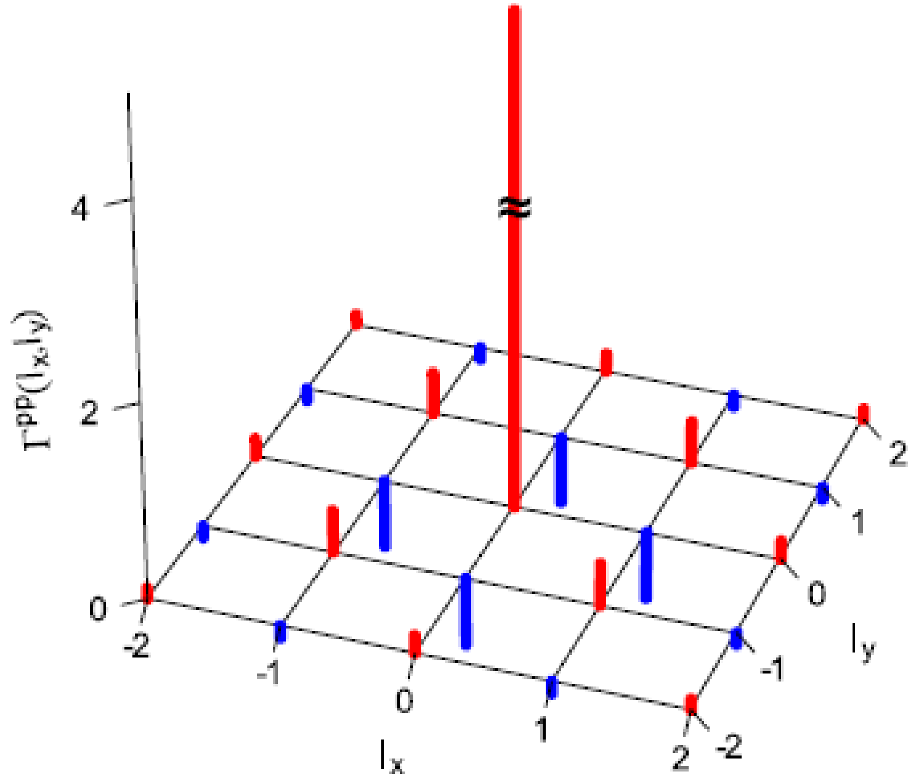

FIG. 19 (color online). The real space structure of the pairing interaction obtained from the Fourier transform Eq. (11) of $\Gamma^{pp}(k, k')$ at a temperature $T = 0.125t$ for $U = 4t$ and $\langle n \rangle = 0.85$. Here there is an attractive pairing interaction for a singlet formed between an electron at the origin and a near-neighbor site. The peak in Γ^{pp} shown in Fig. 18 leads to a pairing interaction which oscillates in space.

$$V_s(\ell) = \sum_q e^{i\vec{q}\cdot\vec{\ell}}\, V_s(q, \omega = 0)$$

Fig. 6. Fourier transform of the singlet-pairing interaction $V_s(q)$ of Fig. 4 arising from the short-range antiferromagnetic spin fluctuations on a square lattice. Here one member of the singlet pair is located at the origin and the other at a surrounding site ℓ. The potential is strongly repulsive for both electrons on the same site, as shown by the large positive bar at the origin. However, the potential is attractive on near-neighbor sites.

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