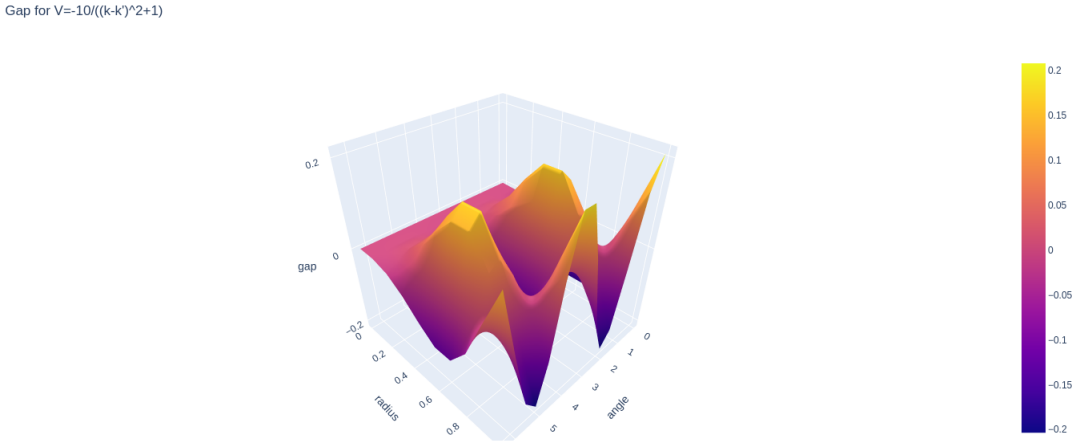
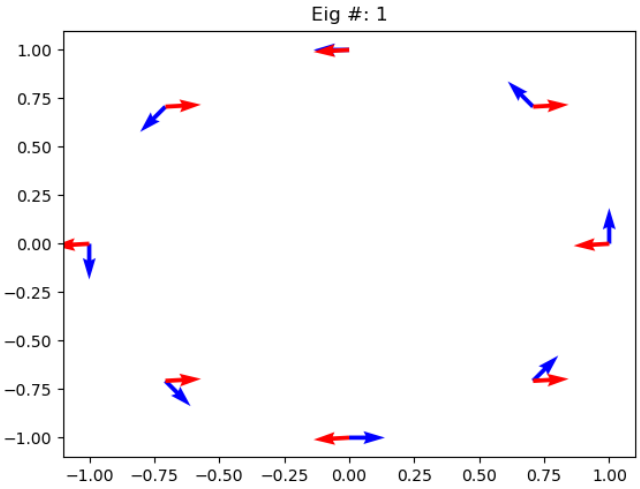
Testing d-wave direction for different potentials

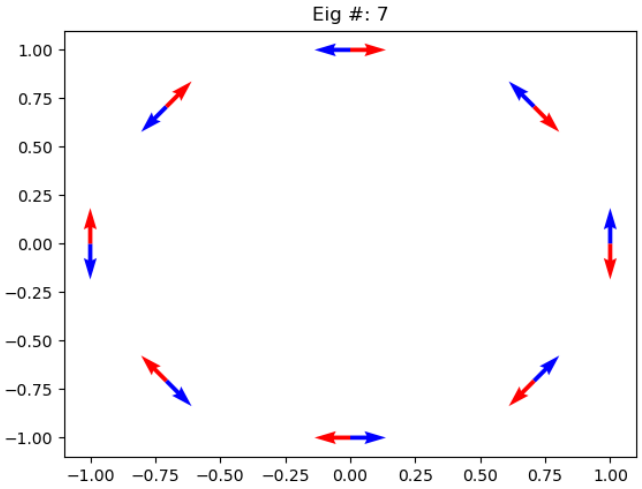
While the wavefunction follows the general form that we might expect, as seen in the plot below, we have still not found that the wavefunction follows the same direction as the g-vector, which in the paper is said to be the state with the highest superconducting temperature.



$$V = -\frac{10}{(1+|k-k'|^2)}$$



This is the first eigenvalue, and the $d||g$ state is not found until eigenvalue #7. This eigenvalue is 1/10th the size of the highest eigenvalue, and so corresponds to a lower critical temperature.



V is the Coulomb Potential and Acoustic Phonon Pairing

$$V(\mathbf{k},\mathbf{k}') = -V_{ph}(\mathbf{q})\Theta(\omega_D - |\xi_{\mathbf{k}}|)\Theta(\omega_D - |\xi_{\mathbf{k}'}|) + V_c(\mathbf{q})\Theta(\omega_p - |\xi_{\mathbf{k}}|)\Theta(\omega_p - |\xi_{\mathbf{k}'}|)$$

$$V_{ph}(\boldsymbol{q}) = \frac{C^2}{NMc_\perp^2(1+\alpha q_{||}^2/q^2)}, V_c(q) = \frac{4\pi e^2}{V\epsilon_0(q_s+q^2)}$$

For simplicity, we set all the constants equal to 1, while still maintaining the general form of the functions. For an arbitrarily chosen case of $\omega_D = 2$, $\omega_p = 1$, we find that there are no solutions where $d||g$, a result I do not understand.

Conclusion/Questions

Does $d||g$ matter? The paper states that this is the point where superconducting temperature is the highest.

However it also says that "With the reduced symmetry of a crystal, it is usually not possible to find $d(k)||g_k$ which satisfies the linearized gap equation for a giving pairing interaction $V_{kk'}$. Nevertheless, we could determine a nearly optimal spin-triplet state compromising between the pairing interaction and the effect of H_p. Very recently Samokhin et al. carried out relativistic band structure calculations which indicate that $\alpha >> k_B T_c$ in $CePt_3Si$."

So should I be searching for the parallel state and if so what potential $V_{kk'}$ should I be using? And if not, where should I look for the potentials of Distrontium ruthenate?