

## 1 Polaron problem

- Energy of polaron  $E_k$ :

$$E_k = -\hbar\omega\alpha + \frac{\hbar^2 k^2}{2m^*} \left(1 - \frac{\alpha}{6}\right) \quad (1)$$

- Selfenergy  $E_0$ :

$$E_0 = -\alpha\hbar\omega \quad (2)$$

→ Energy offset

- Effective mass  $m^{**}$

$$m^{**} = m^* \left(1 + \frac{\alpha}{6}\right) \quad (3)$$

→ Heavy electron

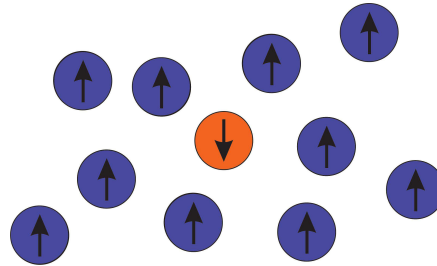


Abbildung 1: Spin polaron

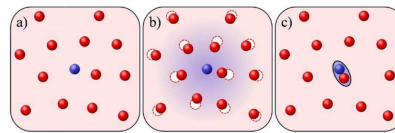


Abbildung 2: Possible states for impurity in Fermi Sea of spin up particles [1]

## 2 Superfluidity for fermions in imbalanced situations

- FFLO phase predicted
- Forming of CP with finite momentum
- Different phases depending on the polarization
  - Partially paired
  - Completely paired
  - Fully polarized

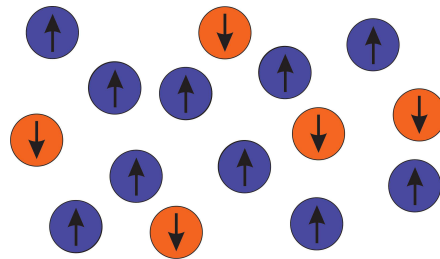


Abbildung 3: Imbalanced Fermi sea

- 1D situation necessary
- No experimental proof!
- Hope to find FFLO signature in RF spectra

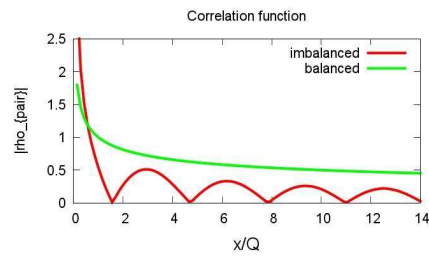


Abbildung 4: Oscillating order parameter

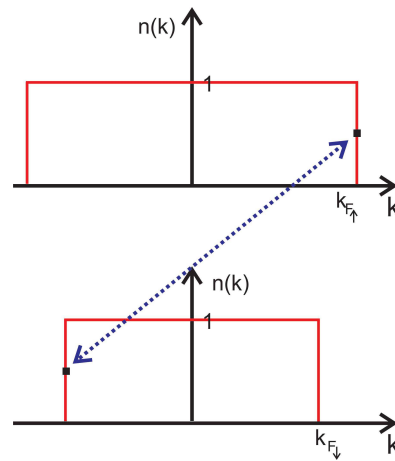


Abbildung 5: Pairing with finite momentum

## Literatur

- [1] Schirotzek, André and Wu, Cheng-Hsun and Sommer, Ariel and Zwierlein, Martin; Observation of Fermi Polarons in a Tunable Fermi Liquid of Ultracold Atoms, *Phys. Rev. Lett.*, **102**, 30402-230405, (2009).