5.1 One electron approximation

we will have a closer look on a many particle system in which the one electron approximation is allowed, i.e.

- each electron will occupy a one electron state independently of all the other electrons
- electrons in different one electron states do not "recognize" each other
- within one state the Pauli principle has to be obeyed, i.e. each state can only be occupied once; taking into account the spin two electrons can occupy one state.
- Since the one electron states have been calculated by diagonalization of the Hamiltonian, there exists no overlap between different one electron states.
- Consequently there exists no scattering between those states
- the system does not change in time

All perturbations from outside

- will change the Hamiltonian for a short time
- will introduce particles which are not Eigenstates of the Hamiltonian
- will induce particles which couple to the electrons and lead to scattering of electrons into different states

Electrons will be scattered into mixed states $\psi = \sum_n c_n f_n$

- this mixed state will relaxate into a pure state f_n with a probability $|c_n|^2$
- Since a macroscopic state is filled with many electrons, this is equivalent to the statement that a mixed state will relaxed into pure states according to the $|c_n|^2$.

The **dominant and most fundamental perturbation of all systems** is the temperature; e.g. the Brownian motion of the particles will excite electrons leading to a constant interaction between electrons. There exists a continuous flux of electrons into neighboring states. This flux is defined by $|c_n|^2$, i.e. the mixture of pure states. The coefficients $|c_n|^2$ are calculated from the matrix elements

$$\langle f_m | Perturbation | f_n \rangle \tag{5.1}$$