Heisenberg model of Weiss magnetic field

In classical dipole interaction internal field of strength (Range 10^6 - 10^7) can not be explained . Heisenberg in 1928 , interpreted that such high value of inter field can be explained in terms of exchange interaction between the electrons . This exchange force appears in the form of spin –spin interaction because orbital states of the electron impose limitation due to Pauli principle .

If interatomic separation decreases more and more , exchange force decreases until they pass through zero and an anti-parallel spin is favoured .

The microscopic models of magnetic interactions are classified in term of:

Dimensionality of the order parameter D

space dimensionality d

D (=1, 2, 3) depends on the number of components of Sx , Sy and Sz of the

spin operator S.

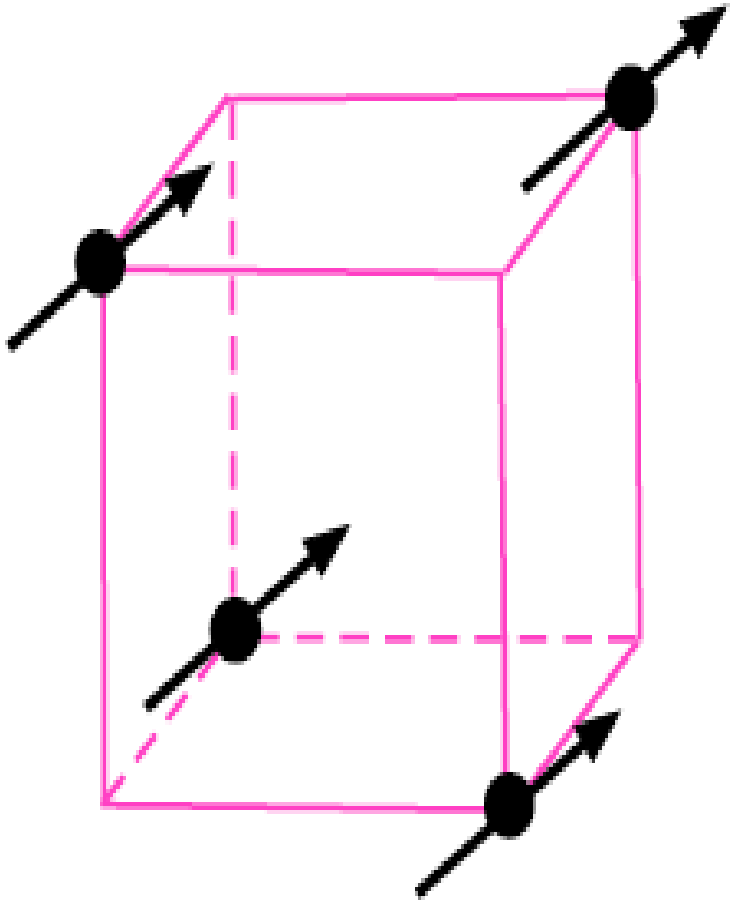
Heisenberg model: D=3

Spins are 3D vectors

The lattice dimensionality d=1,2,3…

$$\hat{H}_{Heisenberg} = -\sum_{\langle ij \rangle} J \mathbf{S}_i \cdot \mathbf{S}_j$$

Heisenberg 3D, 3d



Heisenberg 3D, 2d