Quantum Phase Transition and Quantum Critical Point

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Abstract: Discussing quantum phase transition and quantum critical point

Main Viewpoints and Conclusions:

In physics, a quantum phase transition (QPT) is a phase transition between different quantum phases (phases of matter at zero temperature). Contrary to classical phase transitions, quantum phase transitions can only be accessed by varying a physical parameter—such as magnetic field or pressure—at absolute zero temperature. The transition describes an abrupt change in the ground state of a many-body system due to its quantum fluctuations.[1]

In fact and details, the study of the quantum phase transition and quantum critical point, is the study about of a material in a condition which with a definite electromagnetic and pressure environment, and when the temperature continues change to lower, until reaches absolute zero temperature, the properties changing of this material with the changes of the environment temperature (whether it is a single atom or more kinds of atoms of the crystal compound, and especially with regards to solid material).

With a definite electromagnetic and pressure environment, the environment temperature continues change to lower, until reaches absolute zero temperature, in the process, the material lost its energy continuously, so, the energy both of the all extranuclear charges and all nucleuses (main is π-mesons body) of the material also is go into further lower continuously. Meanwhile, the volume density, natural frequency and energy level of the extranuclear charges go into further lower continuously; the difference of the volume charge density, natural frequency and energy level between all parts of the material becomes to smaller, and reaches the same and consistency at absolute zero temperature. In the state, all atoms of the material at the same and lowest energy level of their ground state, the extranuclear-charges of all atoms with the same density and polymerized into a single complete whole and agglomerate together with all nucleuses, namely, the material is being its Bose-Einstein condensate (BEC).[2][3][4][5]

The process of the volume density, natural frequency and energy level of the extranuclear charges go into further lower continuously; the difference of the volume charge density, natural frequency and energy level between all parts of the material becomes smaller, also is a process that the energy ground state of every parts of the extranuclear charges goes

into more lower state which higher than *the lowest energy level-ground state*, and this is the weak first-order quantum phase transition which we called that the energy levels from higher to lower but still higher than *the lowest energy level-ground state* yet; further, we called the quantum state transition is second-order quantum phase transition which the energy levels of every parts of the extranuclear charges from many different higher energy levels goes into the same and *lowest energy level-ground state* after the material reach into and at its Bose-Einstein condensate (BEC); and the environment condition (combined effect generated by magnetic-field, pressure and temperature) that is the *quantum phase dividing line* or called quantum critical point which makes the material reaches into its Bose-Einstein condensate and the all extranuclear charges from different volume charge densities, natural frequencies and energy levels transform into a single complete whole which with the same and unique volume charge density, natural frequency and energy level at its ground state; in short, the quantum critical point is the dividing line of the two state that the all extranuclear charges with many different volume charge densities, natural frequencies and energy levels or the all extranuclear charges with the same and unique volume charge density, natural frequency and energy level at its ground state.

References

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