Proposition for a new theory of the mechanism of high-temperature superconductivity

Kazuo Abe

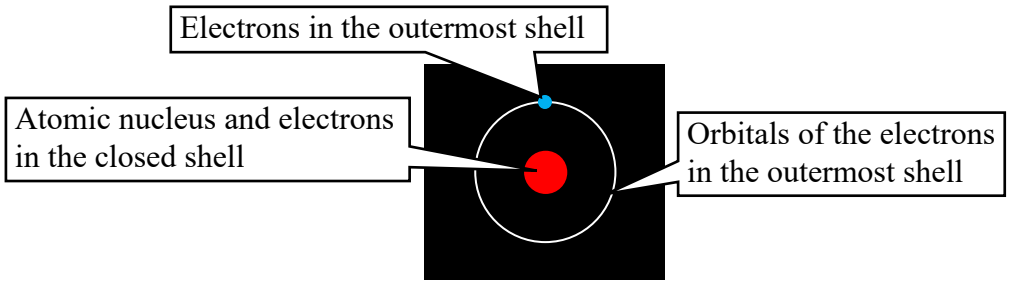
Japan

Abstract

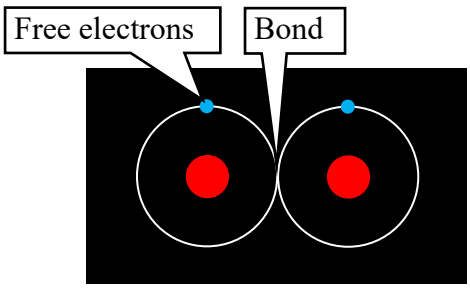
We propose a new high-temperature superconductivity theory that leads to room temperature superconductivity. We presume that the cause of electrical resistance is a vacuum gap formed irregularly outside the free electron orbital region by thermal vibration.

Till date, there is not an established theory of the mechanism of high-temperature superconductivity. In this paper, we propose a new theory.

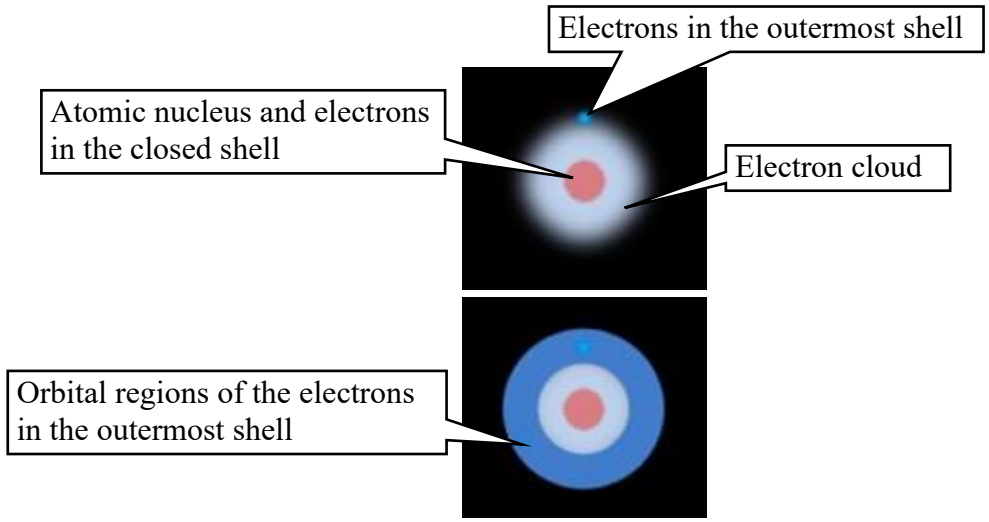
First of all, a general two-dimensional model of an atom.



Diatomic bond, which creates free electrons.



A slightly more realistic model.



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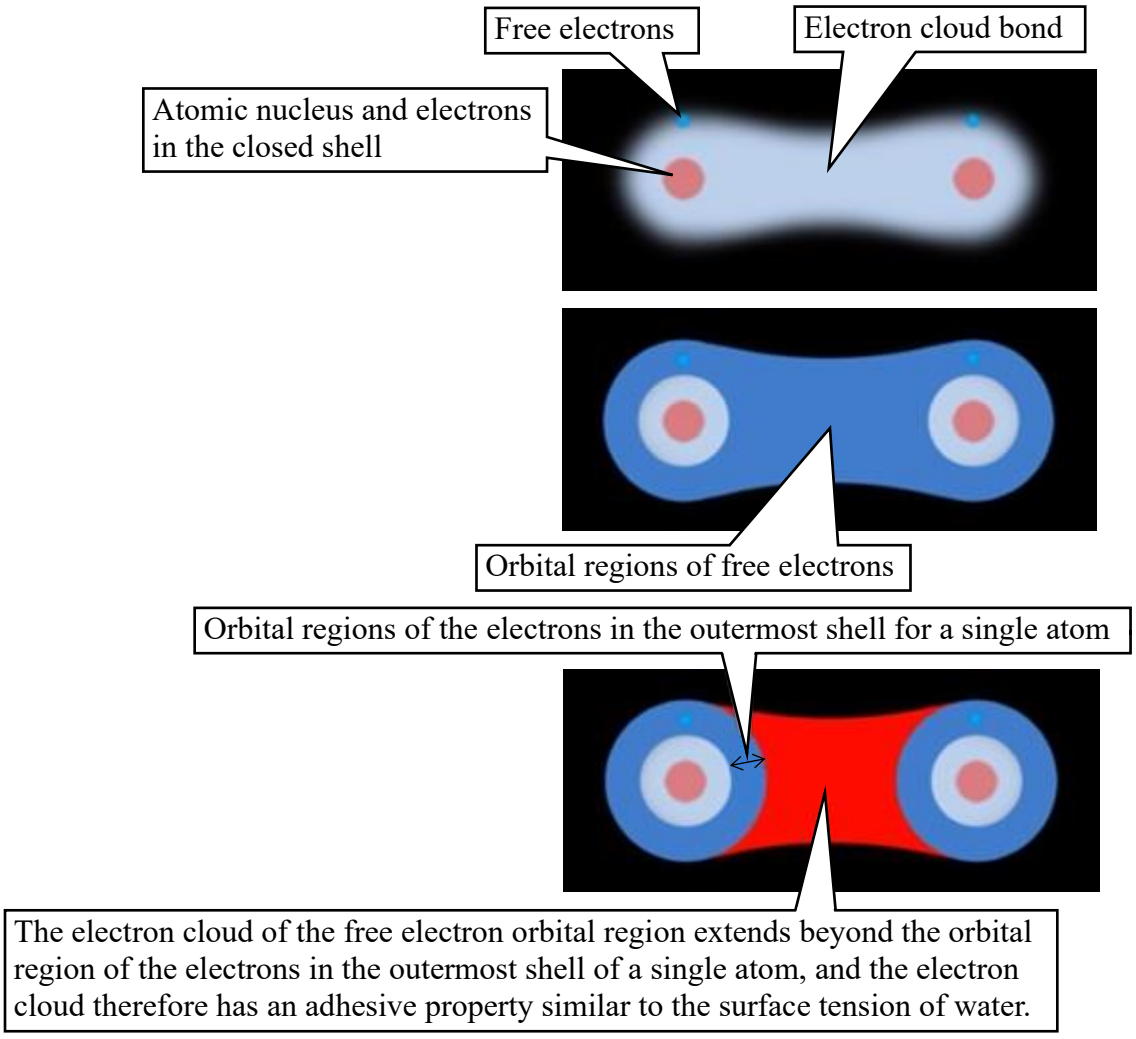

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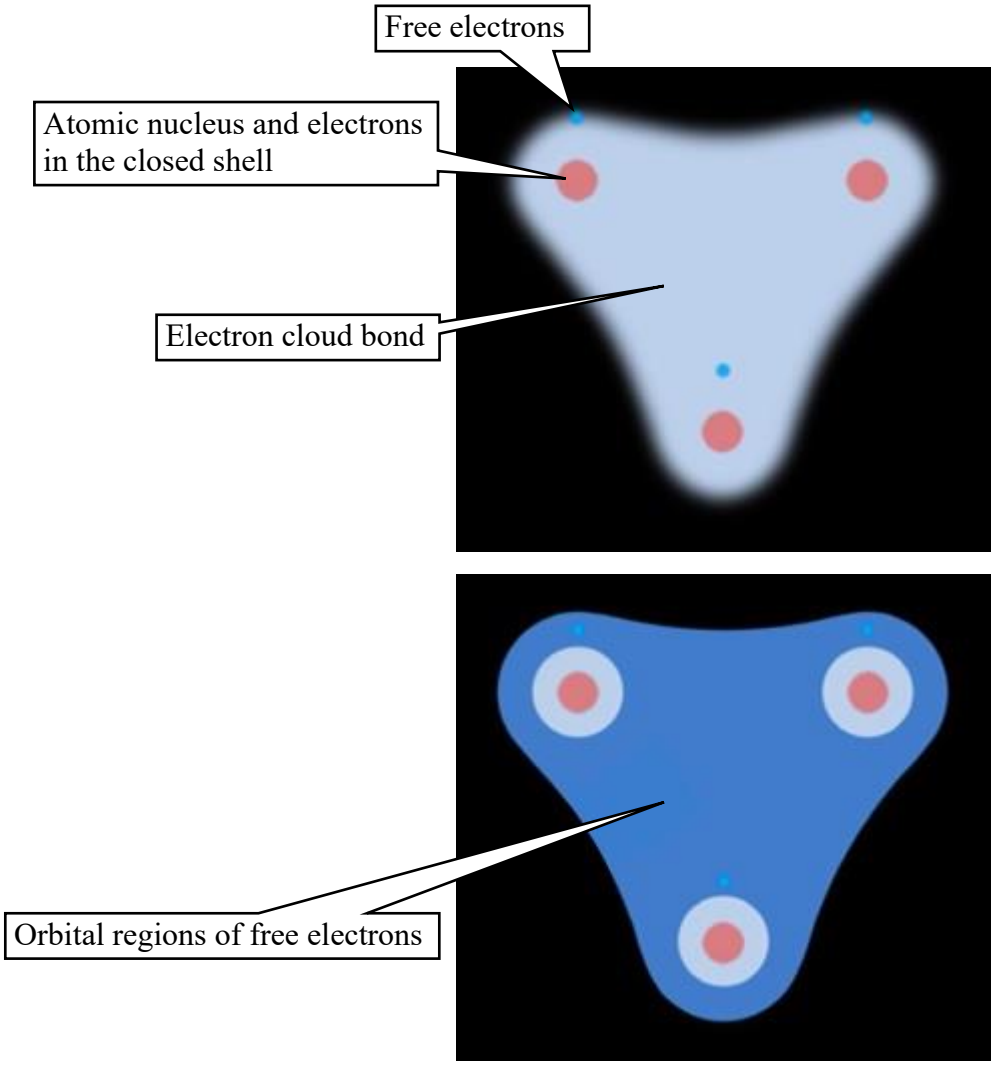
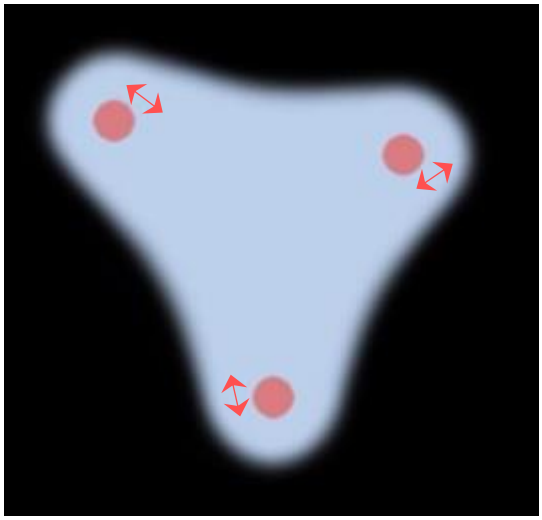
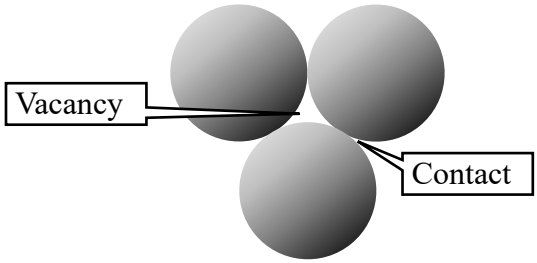


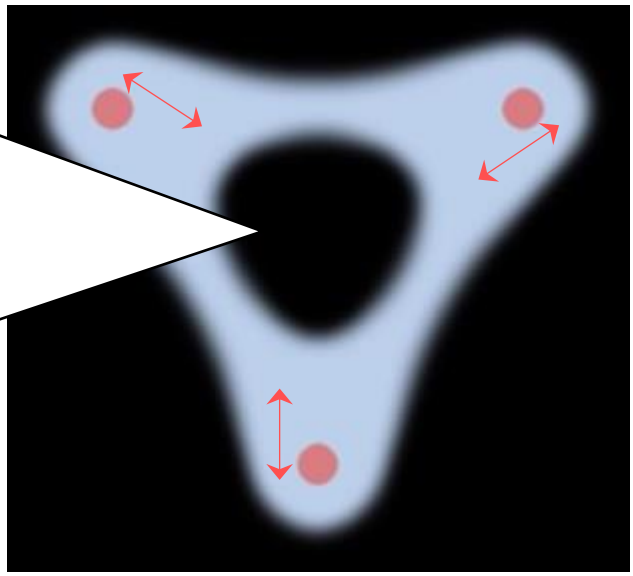
Atoms in thermal vibration when a conductor is heated to raise the temperature.



The thermal vibration is intensified by additional heat.
When the three atoms swing to the outer side by chance.

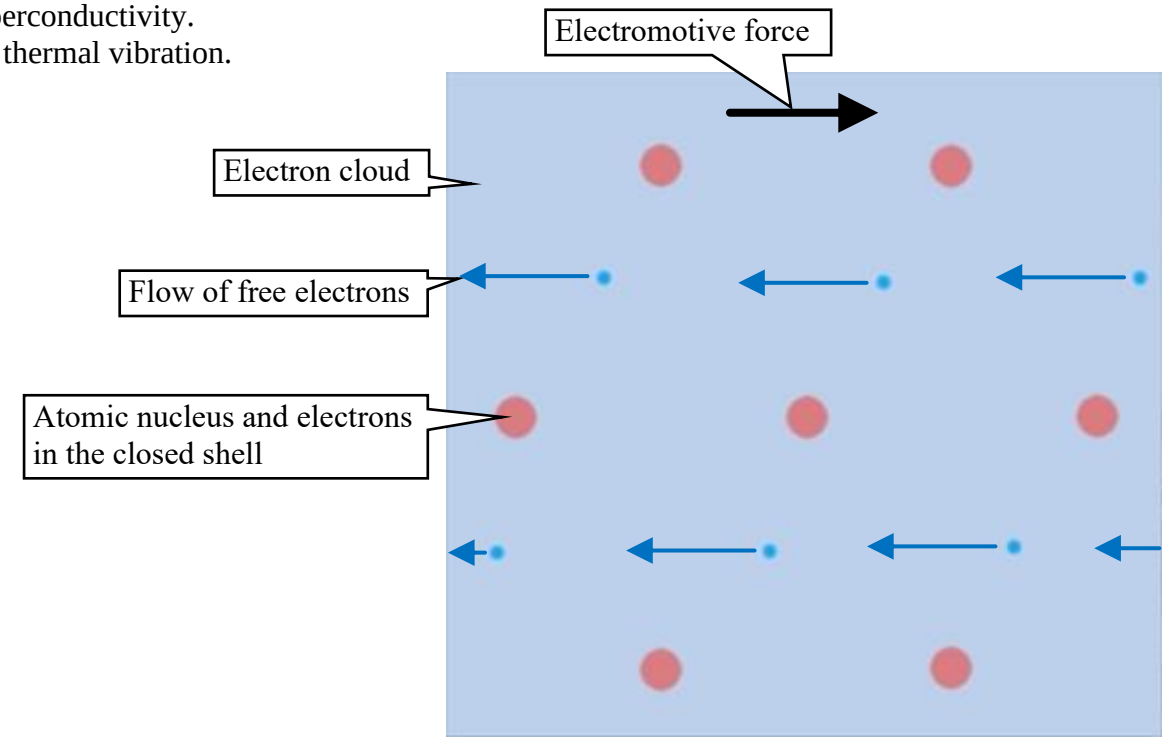
It is supposed that a vacancy develops at the center, which is not covered by the free electron orbital region. This vacancy does not indicate a broken bond, and the neighboring atoms are all bonded. It is analogous to the case where all the neighboring spheres are in contact, but there are vacant spaces between them.



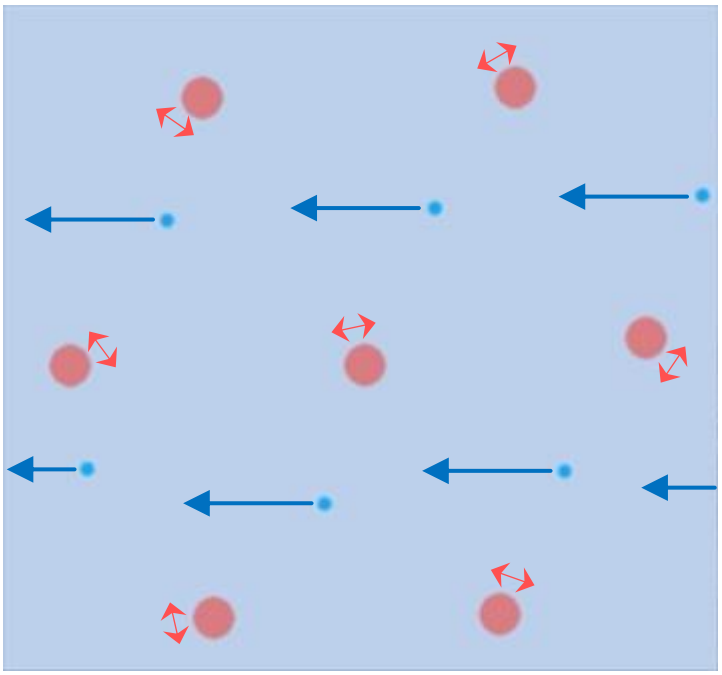


And the free electrons driven by electromotive force cannot pass out of their orbital region through the vacancy and thus bounce back. This is presumably the cause of electrical resistance.

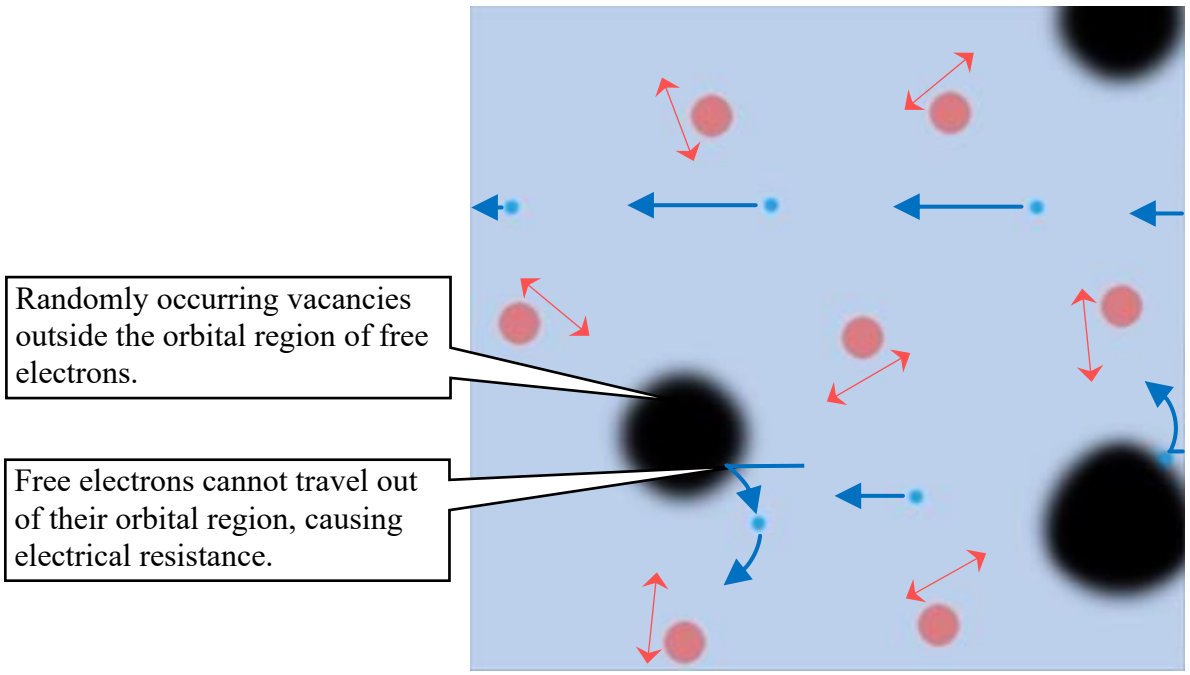
Free electrons flowing in a conductor by the electromotive force.
Superconductivity.
No thermal vibration.



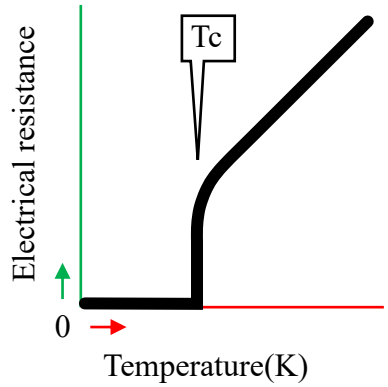
Superconductivity.
Thermal vibration at temperatures below the superconducting transition temperature (Tc).



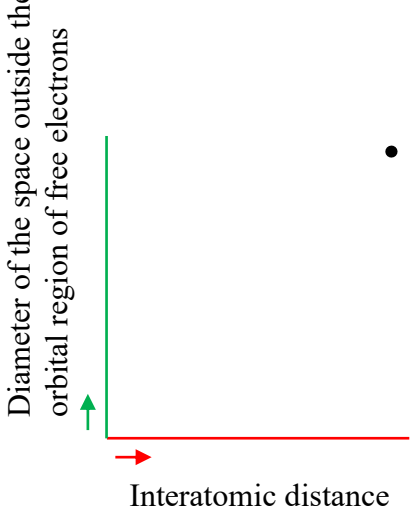
Normal conduction.
Thermal vibration at temperatures above the Tc.

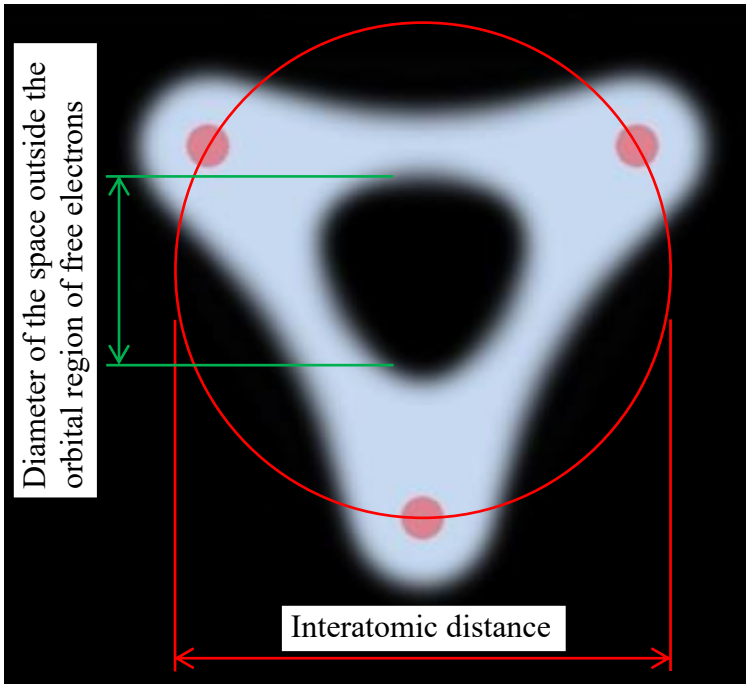


This proposition explains the phenomenon wherein as temperature decreases, the normal conductivity suddenly transitions to superconductivity with zero electrical resistance at the Tc.

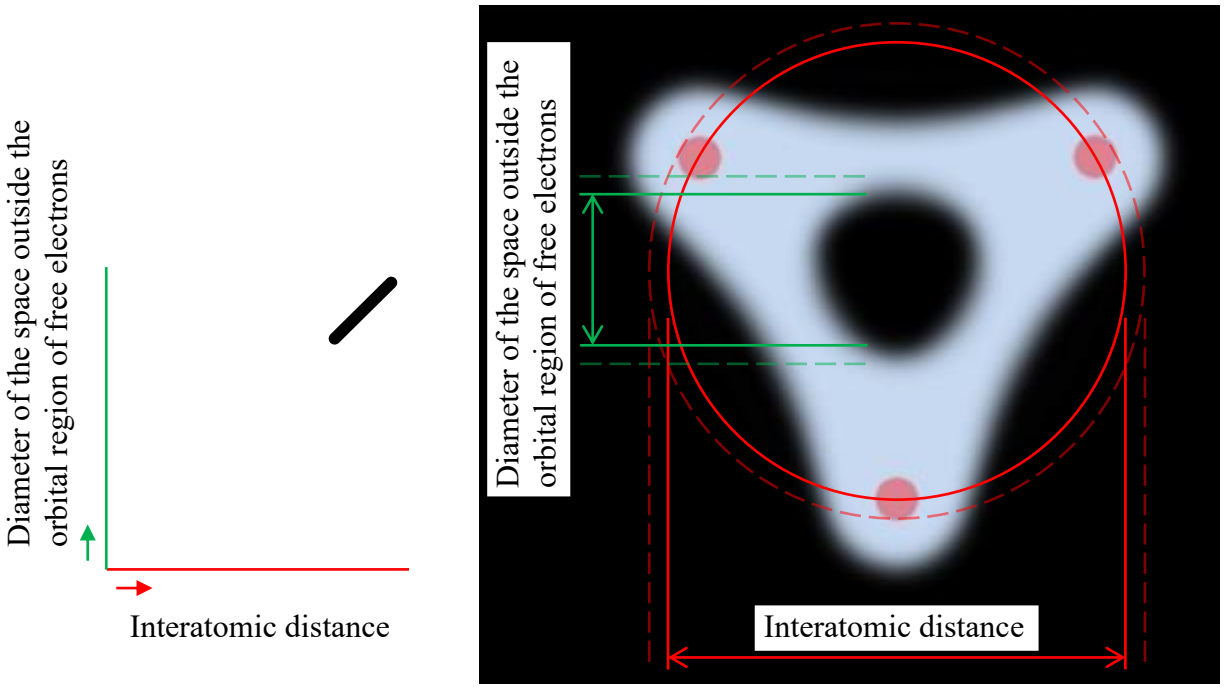


Relationship between "interatomic distance" and "the diameter of the space outside the orbital region of free electrons".

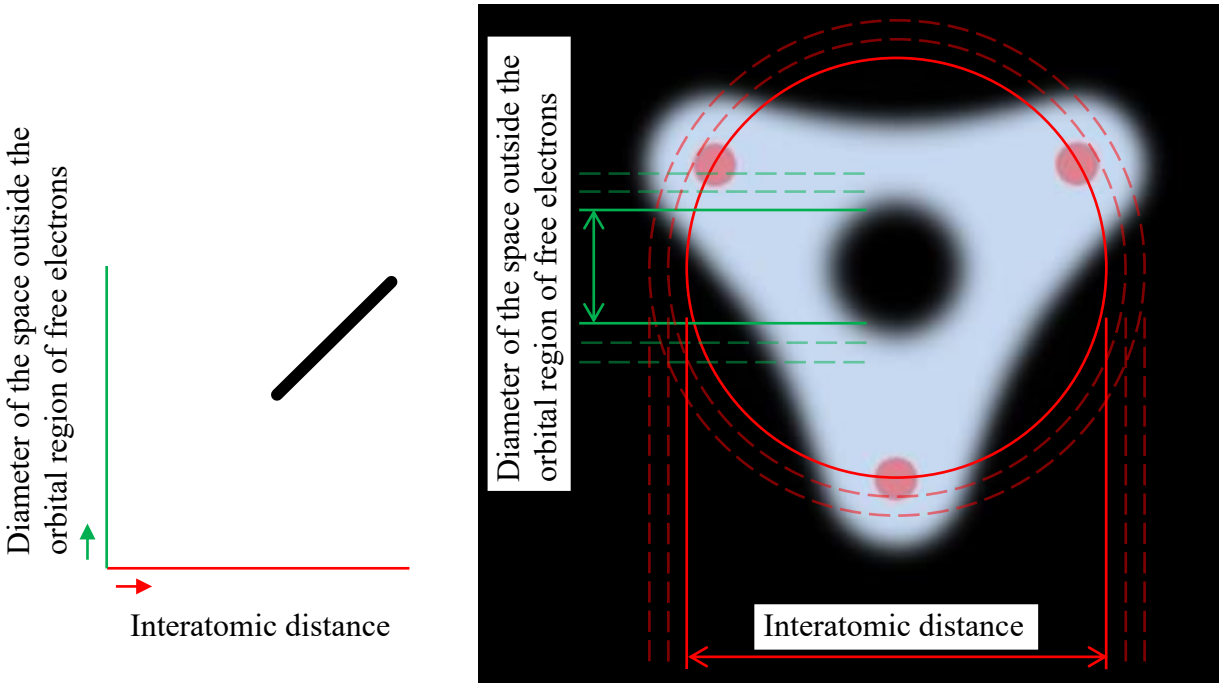




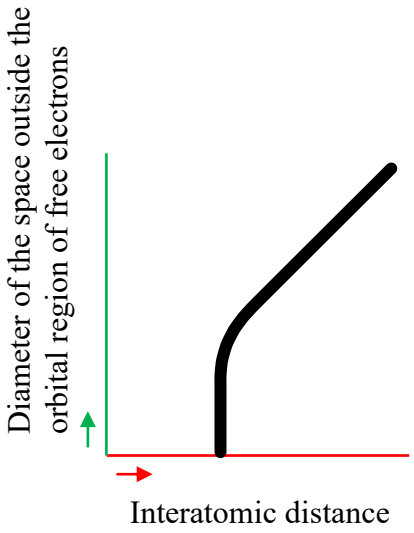
A state in which the interatomic distance is slightly decreases due to thermal vibration.

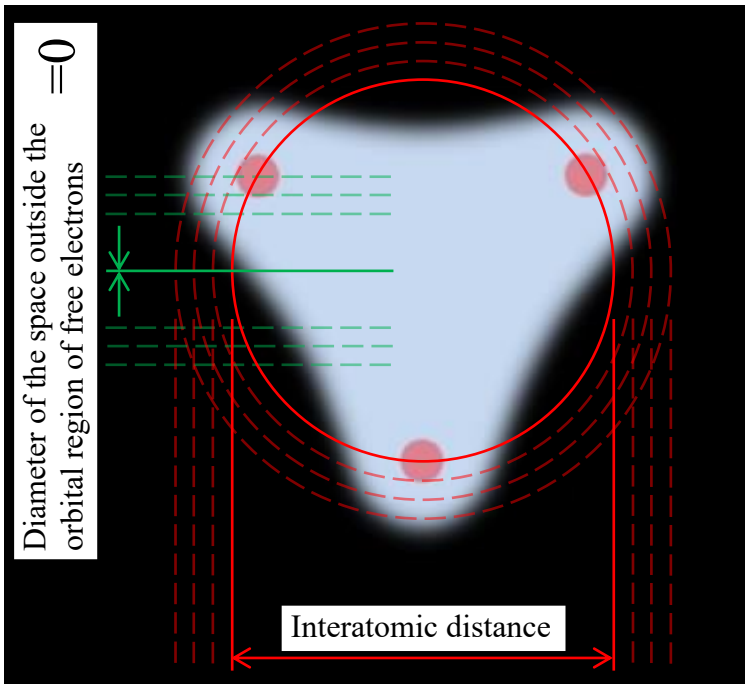


A state in which the interatomic distance is even decreases.



At a certain point as the interatomic distance decreases, the space outside the free electron orbital region suddenly shrinks due to the adhesive property of the electron cloud bond. In other words, when the thermal amplitude drops to a certain degree, the randomly occurring spaces outside the free electron orbital region suddenly shrinks and will not occur. This theory suggests that the electrical resistance suddenly becomes zero at the Tc.





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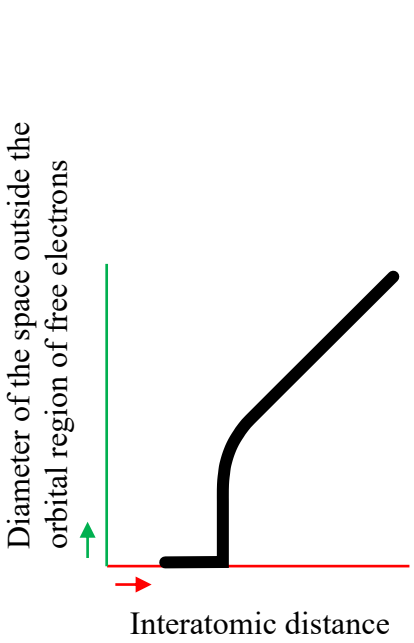
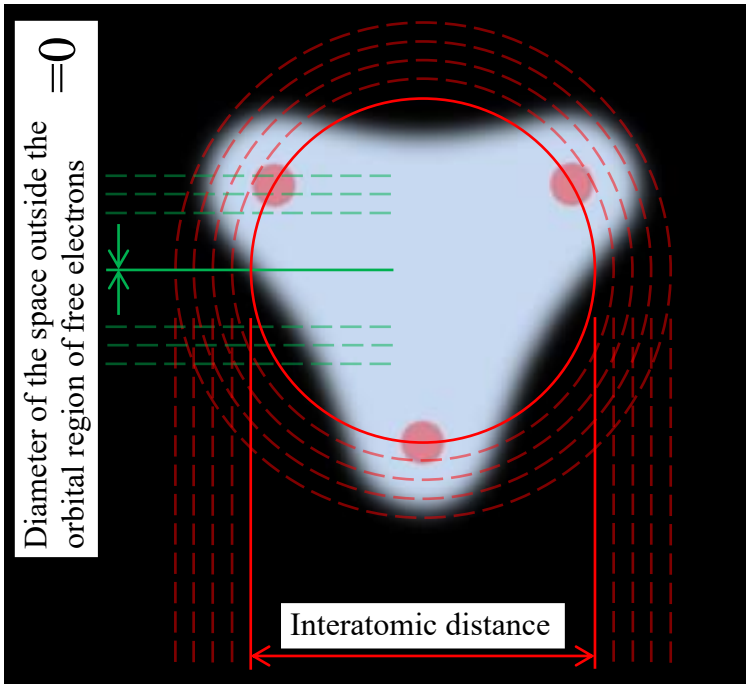
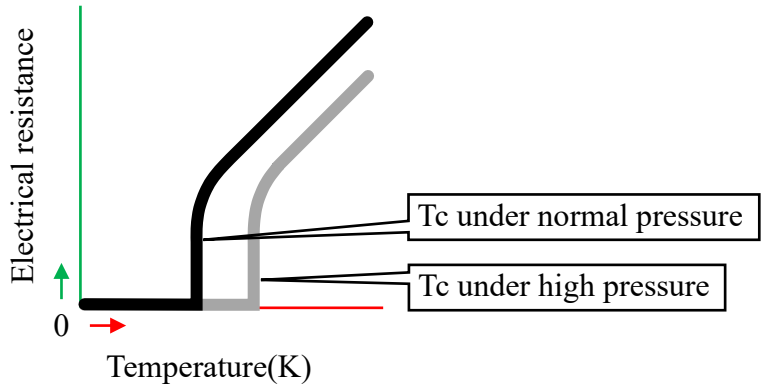
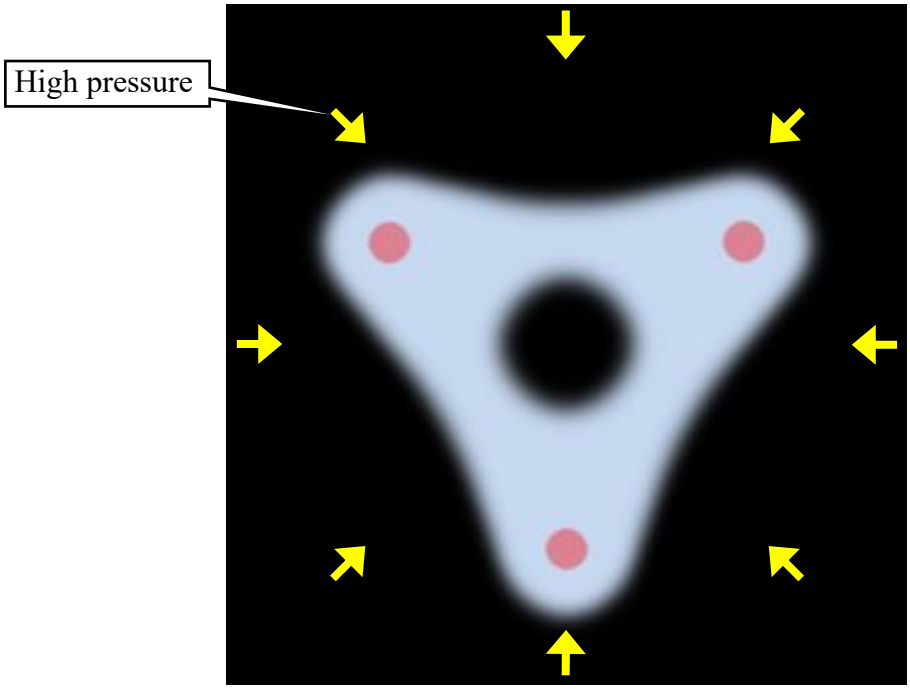




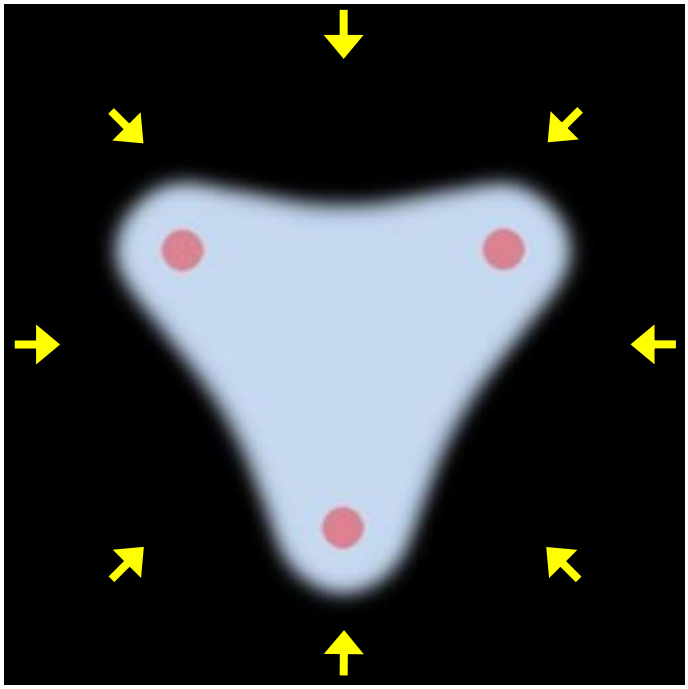
This theory also explains the phenomenon that the Tc rises under high pressure.



Under high pressures, even for the thermal vibration with the same amplitude, vacant regions between the free electron orbital regions occur less frequently due to the reduced interatomic distance. Therefore, the Tc rises.



Disappearance of the region outside of the free electron orbital region.



Summary:

1. Electron cloud where free electron orbitals are bonded has an adhesive property similar to the surface tension of water.

2. Randomly occurring vacancies outside the free electron orbital region cause electrical resistance.

3. When the temperature is decreased to the Tc, the space outside the free electron orbital region suddenly shrinks due to the adhesive property of electron clouds, causing zero electrical resistance.

4. Under high pressure, the interatomic distances become shorter and the space outside the free electron orbital region occurs less frequently, raising the Tc.

5. Conductors that have finite electrical resistance even at absolute zero (0 Kelvin) have molecular structures with vacant regions outside the free electron orbital region even without thermal vibration.

6. From the above observation, it is inferred that superconductivity at room temperature is possible in compounds or molecular structures in which vacant regions outside the free electron orbital regions do not occur by thermal vibration or under normal pressure at room temperature.

Video commentary on this theory
https://youtu.be/kNhcKBStRW0