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Hole Superconductors

Abstract: A hole is the absence of electron, and it carries a positive charge. Electrons in metals are dressed (interact with other electrons and even ions in a material) by a cloud of other electrons that surround it and interact with it. Such an interaction or dressing leads to increase in the effective mass of the electron, and the electrons in this state are called heavy electrons. The effective mass of the heavy electrons can vary between 10 mo (mo is the rest mass of the free electron) and 1000mo. thus, when the dressing is large, the metal is unable to conduct electric current and may even behave like an insulator if the heavy electrons are locked in some space in the metal. It is found that when the temperature is lowered, the electrons manage to undress and the interaction with the surrounding cloud is sufficiently reduced leading to lowering of the effective mass. This leads to easy flow of current that may be large. Creation of such large current leads to superconductivity. Such a process can occur only if the carriers in the metal in the normal state are holes and not electrons such that the undressing takes place when two hole carriers with opposite spin form a pair. When holes undress, they turn into electrons and as electrons, they behave as giant atoms resulting in a superconducting state. Hence the model of hole superconductivity demands or postulates that the mobility of holes increases with the hole concentration in the system. However, for field carrier concentration, as the temperature is lowered, the system becomes superconducting.
Keywords: Hole, Dressing, Effective mass, Heavy electrons.

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