The latest world achievements in the field of superconducting

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My report is about superconductivity, it's characteristics, types and application of this phenomenon in our every day life and the possibility to employ it in future in Moldova.

The history of physics in the XX-th century has been totally marked by the discovery of superconductivity. The discovery of this phenomenon began in 1911 with the experimentally work of Kamerlingh Onnes.

So we have that superconductivity is a phenomenon occurring in certain materials generally at very low temperatures, characterized by exactly zero electrical resistance and the exclusion of the interior magnetic field (the Meissner effect).

Superconductibility has two important characteristics:

- persistent electric currents that continue to flow without an electric potential driving them.
- perfect diamagnetism (or supradiamagnetism)- the phenomenon occurring in certain materials at low temperatures characterized by the complete absence of magnetic permeability and the exclusion of the interior magnetic field (also named Meissner effect).

The electrical resistivity of a metallic conductor decreases gradually as the temperature is lowered. However, in ordinary conductors such as copper and silver, impurities and other defects impose a lower limit. Even near absolute zero a real sample of copper shows a non-zero resistance. The resistance of a superconductor, despite of these imperfections, drops abruptly to zero when the material is cooled below its "critical temperature". An electric current flowing in a loop of superconducting wire can persist indefinitely with no power source. Like ferromagnetism and atomic spectral lines, superconductivity is a quantum mechanical phenomenon. It cannot be understood simply as the idealization of "perfect conductivity" in classical physics.

There are two main types of superconducting materials which are known as type-I and type-II superconductors. All of the pure elemental superconductors are type-I, with the exception of niobium, vanadium and technetium. Superconducting alloys and high critical temperature ceramics are all type-II, and these are the materials that are used in most practical applications.

So let's discuss the application of superconductors. Soon after Kamerlingh Onnes had discovered superconductivity, scientists began dreaming about practical applications of this strange new phenomenon. At present, a substantial fraction of electricity is lost as heat through resistance associated with traditional conductors such as copper or aluminum. A large scale shift to superconductivity technology depends on whether wires can be prepared from the brittle ceramics that retain their superconductivity at 77 K while supporting large current densities. The use of superconductors for transportation has already been established using liquid helium as a refrigerant. Prototype levitated trains have been constructed in Japan by using superconducting magnets.

Superconducting magnets are already crucial components of several technologies. Magnetic resonance imaging (MRI) is playing an ever increasing role in diagnostic medicine. The intense magnetic fields that are needed for these instruments are a perfect application of superconductors.

The ability of superconductors is used in our daily life, the only question is how much time will it take to see this technology in a worldwide view, it will help us to reduce losses of electric current and find some solutions in other domains, like medicine, levitating trains etc.

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