

核物質中のハドロン・凝縮系中の原子核へ及ぼす媒質環境の効果

Medium effects; Hadrons in nuclear matter and Nuclei in condensed matter

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Modification of properties of constituents in surrounding environments is one of the most interesting and important phenomena in physics. As the world shows layer structures, quark – hadron(meson/baryon) – nucleus – atom/molecule – liquid/solid - - -, the medium, in which the basic constituents of the layer interact to each other, is considered to play an important role for the modification. However, it is very hard to see clear effects of medium acting on its substructure. Recently, the role of media has been studied more deeply at various stages of layer structure. For example, in a nucleus which provides a matter environment with a finite baryonic density, reduction of nucleon and meson masses has been discussed in the framework of QCD as well as a possibility of partial deconfinement of quarks. Moreover, in condensed matter, nuclear reactions and/or nuclear decays are considered to be strongly modified by the existence of electrons in extreme conditions.

We have studied medium effects relating to nuclei; properties and behaviors of hadrons in nuclear matter, and, nuclear reactions and decays in condensed matter. We would like to discuss mainly the following subjects in my talk; properties of the $S_{11}(1535)$ nucleon resonance in nuclei, reaction rates of low-energy nuclear fusion reactions in condensed matter, and, modification of lifetime of ${}^7\text{Be}$ in C_{60} fullerene. Most of the experiments have carried out at the Laboratory of Nuclear Science. The results so far obtained have generally indicated that the medium effect is not small, but rather strong for specific conditions. The $S_{11}(1535)$ resonance appears with larger resonance width in nuclei than in isolated. Low-energy $\text{D}+\text{D}$ and $\text{Li}+\text{D}$ reactions are enhanced very strongly in some metals. The shortest lifetime of ${}^7\text{Be}$ ever reported has been deduced in C_{60} . We will discuss on these experiments in detail as well as future plans.