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Maria Goeppert Mayer's work on beta-decay and pairing, and its relevance today

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Maria Goeppert Mayer's work on beta-decay and pairing is not as well known as her Nobel Prize winning work on the nuclear shell model, but it attests to her wide range of accomplishments. Her paper on double beta decay was the first one written on the subject. Later she also worked on the application of beta decay as a test of the nuclear shell model. Due to its very long half-life, double beta-decay was not found experimentally until the 1980's. This involves emission of two neutrinos along with the two electrons. However, in principle it is also possible to have double beta decay with no neutrinos, a process which was identified about 10 years ago, though this is still quite controversial. Currently, there are several groups working on this problem, which has significant implications for particle physics and for cosmology. It was known from the earliest days of nuclear physics that nuclei with even Z and even N are more stable than others due to the pairing effect. Indeed, all nuclei in which double beta-decay is looked for are even-even and this would not be possible were it not for pairing. In MGM's paper on pairing, published shortly after the ones on the magic numbers and role of spin-orbit coupling, she used a very simplified zero range nuclear interaction. There has been considerable work on pairing in the meantime. It is still an open problem how to understand the details of how pairing works in nuclei, in terms of realistic nucleon-nucleon interactions.