

An improved Pulse Shape Discrimination (PSD) method to detect directly for a non-baryonic dark matter

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For the several decades, the non-baryonic dark matter has been searched in many ways and by many research teams. Non-baryonic dark matter is known as a weakly interaction and neutral particle. In the direct detection ways, it is not easy to identify a non-baryonic dark matter from other particles, such as gamma ray and neutron, due to its electric neutrality. So, the identification of neutral particle is an essential part for the direct detection method of dark matter in a cosmic ray free laboratory with a detector made of radioactive free materials.

A pulse shape discrimination (PSD) method was introduced more than fifty years ago. And it has been used by various elementary particle experiments. We need a more precise PSD method to detect directly dark matter interacting rarely.

We can see the primary and the secondary signals in the scintillation produced by an elastic scattering between an incident particle and a target atom. The primary signal is composed of the scintillations from an excitation process of target nuclear and an ionization process of target atom while the secondary signal is composed of scintillation from ionization process, only. The ratio of scintillations from excitation and ionization processes gives the clue to identify the neutral particles.

Here, we introduce an improved way to separate the primary signal into the scintillations induced by excitation and ionization processes through the elastic scattering between a target atom and a non-baryonic dark matter. This separation of primary signal can provide a big hint to identify a non-baryonic dark matter.

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