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The 17 MeV Anomaly in Beryllium Decays and U(1) Portal to Dark Matter

The experiment of Krasznahorkay et al observed the transition of a ^8Be excited state to its ground state and accompanied by an emission of e^+e^- pair with 17 MeV invariant mass. This 6.8σ anomaly can be fitted by a new light gauge boson. We consider the new particle as a U(1) gauge boson, Z' , which plays as a portal linking dark sector and visible sector. In particular, we study the new U(1) gauge symmetry as a hidden or non-hidden group separately. The generic hidden U(1) model, referred to as dark Z model, is excluded by imposing various experimental constraints. On the other hand, a non-hidden Z' is allowed due to additional interactions between Z' and Standard Model fermions. We also study the implication of the dark matter direct search on such a scenario. We found the search for the DM-nucleon scattering excludes the range of DM mass above 500 MeV. However, the DM-electron scattering for MeV-scale DM is still allowed by current constraints for non-hidden U(1) models. It is possible to test the underlying U(1) portal model by the future Si and Ge detectors with $5e^-$ threshold charges.

Experimental Collaboration

Author: Prof. CHEN, Chian-Shu (Tamkang University)

Presenter: Prof. CHEN, Chian-Shu (Tamkang University)

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