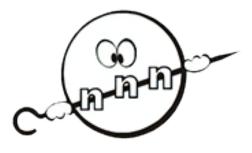
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## Experimental Demonstration of Fast Neutron Absorption Spectroscopy Driven by Repetitive Laser Neutron Source

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Fast neutron absorption spectroscopy enables isotope-specific material analysis with deep penetration and high nuclear sensitivity. However, achieving high-resolution, table-top fast neutron absorption spectroscopy remains challenging, primarily due to constraints in neutron time duration and diagnostic capability. Here, we report the first experimental demonstration of fast neutron absorption spectroscopy using a repetitive laser driven neutron source. With single-neutron counting and pulse shape discrimination techniques, we achieved high-precision, high-resolution (0.02 MeV at 0.5 MeV) neutron spectrum measurements. Magnesium resonance absorption features at 0.268 MeV and 0.432 MeV were clearly resolved. Local Pearson correlation analysis confirmed good agreement of experimental result and theoretical model. This work combines the ultrashort, table-top laser driven neutron source with advanced detection technique, opening a new avenue for non-destructive testing application and fundamental nuclear science.

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