

Space and Time Reversal Experiments by Use of Pulsed Neutron Ramsey Resonance

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The three-fold correlation between neutron spin, momentum and nuclear spin in neutron transmission through a nuclear target has been studied as a new search for T -violation. However, no experiment has been carried out for long time, because of a difficulty in a neutron spin manipulation. We have developed a pulsed neutron Ramsey resonance, which will be a solution for this problem.

Two separated oscillatory fields, which were placed in a pulsed neutron beam line, were synchronized with a neutron pulse as shown in FIGURE 1. We observed the neutron Larmor precession between the two oscillatory fields as a function of a neutron time of flight (TOF) in a specific neutron energy region as well as an oscillatory field frequency.

In addition, the phase of the second oscillatory field was modulated with respect to the first oscillatory field as a function of the TOF. The effect of the phase modulation was found in a neutron intensity modulation as a function of the TOF after transmission through a Ramsey apparatus. From the neutron intensity modulation, the neutron spin direction as well as the neutron velocity between the two oscillatory fields was precisely obtained. This can be applied to a precision spin manipulation for the T -violation experiment, and also for other neutron spin related experiment, for example a neutron β decay asymmetry measurement.

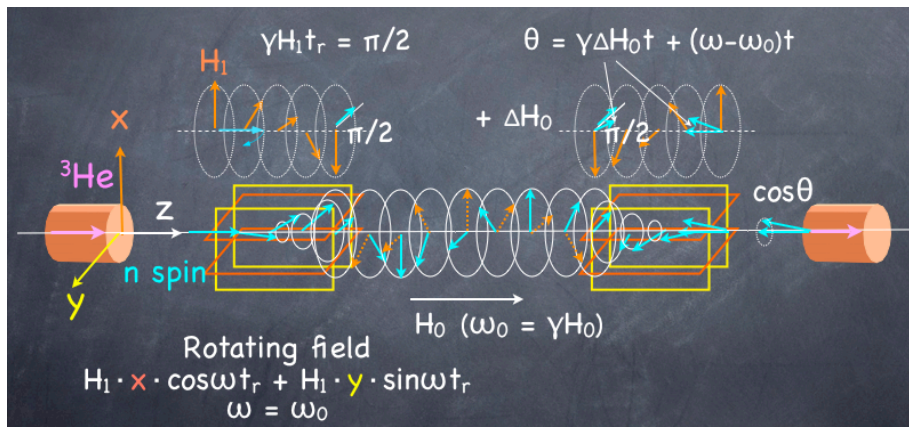


FIGURE 1. Pulsed neutron Ramsey resonance.