Development of a Pixel Detector for Ultra-Cold Neutrons

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Abstract

A pixel detector with high spatial resolution and temporal information for ultra-cold neutrons is developed based on a commercial CCD on which a neutron converter is attached. ^{10}B and ^{6}Li are tested for the neutron converter and ^{10}B is found to be more suitable based on efficiency and spatial resolution. The pixel detector has an efficiency of 44.1±1.1% and a spatial resolution of 2.9±0.1 μm (1 sigma).

Key words: UCN, pixel detector

1. Introduction

When ultra-cold neutrons (UCNs) are trapped in the earth's gravitational field, their energy is quantized. In consequence, their probability density distribution exhibits their vertical modulation. The scale of this density modulation is calculated to be $(\hbar^2/2m_n^2 g)^{1/3} \sim 6$ μm. Observations of such

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