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Two-Crystal Focusing Effect of diffracted neutron

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The effect of two-crystal focusing of neutrons at Laue diffraction from large perfect silicon crystals has been studied. This experiment was done at the framework of the project to test the neutron electroneutrality by new technique using the combination of spin-interferometry method SESANS (Spin Echo Small Angle Neutron Scattering) with the Laue diffraction in perfect crystal.

It has been shown that the focusing effect makes it possible to reach an angular resolution better than $0.03''$, which is about 0.01 of the width of a Bragg reflection. The numerical estimates obtained for such a resolution show that the statistical sensitivity to the neutron electric charge could be $\sigma(en) \approx 1.5 \times 10^{-21} \cdot e$ for the evaluable experimental equipment and neutron beam fluxes. A further improvement of the sensitivity by approximately two orders of magnitude is possible because the own spatial resolution of such a scheme of the experiment can be much higher than the measured value but the more detailed experimental studies at the high flux cold neutron beam are necessary.

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