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最先端融合科学イノベーション教育研究コンソーシアム（CIAiS）

Towards Spin Squeezed ^{171}Yb Atomic Clock beyond the Standard Quantum Limit

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場　所：東京大学理学部 1 号館 2 階 201a 号室

Abstract

State-of-the-art atomic clocks have fractional frequency instability of 6×10^{-17} at 1 s averaging time, and are aiming for even higher stability. One of the main factors limiting this stability is the standard quantum limit of quantum projection noise, which can be overcome by spin squeezing.

We constructed an apparatus to perform spin squeezing on an ytterbium optical lattice clock to demonstrate the enhancement of clock stability by spin squeezing. Using the spin 1/2 system of the ground state Zeeman sublevels of ^{171}Yb, two different methods are utilized to perform a spin squeezing via coupling to $6s6p\,^3P_1$ excited state. One method is measurement-based squeezing, which gave 2.1 dB of spin squeezing. The latter method, cavity feedback squeezing, achieved 8.6 dB of inferred squeezing. The sequence is designed in such a way that the squeezing procedure is unitary. The squeezing of the ground state is expected to be transferred to the excited state of the clock transition. This would be the first observation of an entangled state between the ground state and an electronic excited state, and the resulting spin squeezed atomic clock would be the first optical transition clock enhanced by spin squeezing.

In this seminar, I will describe the concept and the result of the experiment, and discuss the prospects towards spin squeezed optical transition atomic clock, and some other possible direction of the project.

使用言語　：　英語

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