



量子物理学・ナノサイエンス第 279 回セミナー

# Spectroscopy and laser cooling of Antihydrogen: recent advances from the ALPHA Collaboration

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## 概 要

Antihydrogen, the bound state of an antiproton and positron, is the antimatter counterpart of hydrogen, and has only recently been observed spectroscopically by the ALPHA (Antihydrogen Laser PHysics Apparatus) Collaboration at CERN. The spectroscopy of hydrogen atom has played a major role in the development of fundamental physics. The spectroscopy of antihydrogen will be a key for the precision tests of fundamental symmetries between matter and antimatter, as well as the test of Charge, Parity, Time-reversal (CPT) symmetry, and a gravitational test of the Weak Equivalence Principle (WEP). Measurements on antihydrogen are complicated by the need to synthesize and confine the anti-atoms prior to probing a transition of interest. Last year, we have made great progress in the synthesis and confinement of antihydrogen, resulting in hundreds of trapped anti-atoms available at a time for spectroscopy. These successes have enabled us to extend our measurement campaign, with new results for the 1S hyperfine splitting, 1S-2S forbidden transition, and 1S- 2P allowed transition. The 1S-2P manifold contains a cycling transition, presenting the possibility of laser cooling of antimatter. I will provide an overview of the ALPHA experiment, present some of our recent results, and discuss future prospects for continued fundamental symmetry tests with antihydrogen.

参考文献 : Nature, **541**, 506-510 (2017), Nature, **548**, 66-70 (2017), Nature, **561**, 211-215 (2018).

百瀬先生は反水素原子を対象とする高分解能レーザー分光によって、物理学の基本原理を追求する研究を推進されていますが、最近その成果を Nature 誌に立て続けにで発表されています。それらの内容を日本語で平易に解説していただきますので、幅広い分野の方の学生・研究者の方々の参加をお待ちしています。

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