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The ALPHA Experiment: summary of the 2021 Run and contributions of the Brazilian Team

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The ALPHA experiment aims at precise tests of fundamental Physics, using very-low energy, spatially confined samples of antihydrogen ($\bar{\text{H}}$) atoms. In 2021 we published the first observation of laser cooling of antimatter atoms, and the reduced temperature of $\bar{\text{H}}$ sample will allow a more precise spectroscopic measurement of the $1\text{S} - 2\text{S}$ transition. A comparison with similar measurements performed on Hydrogen atoms represents a very precise test of the CPT symmetry. An improved test foresees trapping of H atoms in the ALPHA trap, where systematic effects inherent to the comparison of measurements carried out in different environments will be dramatically reduced. To address this issue, our team in Rio has built a Penning trap for a low-energy source of H^- ions; charged particles have now been confined in our trap, and we're currently working towards increasing the lifetime of the trapped sample and the identification of the different ionic species captured in our trap.

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