**News Release** | Embargoed until November 17, 2010, at 10:00 a.m. PST

# Scientists succeed in trek to capture atoms of antimatter

(Vancouver, BC) – Boldly going where the universe has not gone before, scientists at the CERN laboratory near Geneva, Switzerland have succeeded in capturing anti-matter atoms. In a paper published today in *Nature*, physicists of the ALPHA Collaboration, including key Canadian contributors, describe how they succeeded in containing for the first time atoms of antihydrogen, the antimatter partner of ordinary hydrogen. This breakthrough will allow future detailed measurements of antihydrogen, giving scientists a powerful new tool to help solve the age-old question: "Why is there something, rather than nothing, in the universe?"

Antimatter, or the lack of it, remains one of the biggest mysteries of science. At the Big Bang, matter and antimatter should have been produced in equal amounts, but since they annihilate upon contact, shortly thereafter nothing should have remained but pure energy (light). However, to date all observations suggest that all the antimatter has vanished. To try to understand what happened to "the lost half of the universe", scientists are eager to determine whether there is a difference in the properties of matter versus antimatter that might offer an explanation. The approach taken by the ALPHA collaboration will be to compare a well-known system in physics, the hydrogen atom, consisting of one proton and one electron, with its antimatter counterpart, antihydrogen, consisting of an antiproton and an antielectron.

Antihydrogen atoms were first made at CERN eight years ago, but couldn't be stored, since the anti-atoms touched the ordinary-matter walls of the experiments within millionths of a second after forming and were instantly annihilated. The ALPHA collaboration succeeded by developing a sophisticated "magnetic bottle" using a state-of-the-art superconducting magnet to suspend the antiatoms away from the walls. The experiment showed definitive proof of antihydrogen atom capture for about a tenth of a second. Very few were captured (nowhere near enough to power a starship engine!), but their longevity was more than enough to allow study. This result is the crucial step before commencing detailed studies of antihydrogen. These antihydrogen atoms very well may be the first contained antiatoms in the history of the universe.

A well-known aphorism proclaims that to understand the hydrogen atom is to understand all physics. Makoto Fujiwara, spokesperson for the ALPHA-Canada group, points out, "That is only half right - we still have to understand antihydrogen." CERN Director General Rolf Heuer said, "These are significant steps in antimatter research and an important part of the very broad research programme at CERN." CERN is the only laboratory in the world with a dedicated low-energy antiproton facility to enable this type of research.

ALPHA-Canada scientists have been playing leading roles in the antihydrogen detection and data analysis aspects of the experiment, and also the development towards forthcoming antiatomic structure studies. Richard Hydomako, a Ph.D. student of Prof. Rob Thompson at the University of Calgary and a scholar visiting Prof. Scott Menary at York University, played a crucial role in the data analysis of the reported result. He said "It's been a rare privilege and learning experience taking part in this groundbreaking international endeavor." Important infrastructure support came from TRIUMF in Vancouver, BC, which enabled Canadian scientists to participate in an international project at the level beyond what is normally possible by a single university group. TRIUMF Director Nigel Lockyer was enthusiastic, "This is an historic

achievement and a real testament to the imagination, ingenuity, and inspiration of the scientists and students from TRIUMF, Canada, and around the world."

The ALPHA Collaboration is already exploiting the fruits of their labour. Fujiwara notes that "As we speak, we are trying to measure, for the first time, what colour antimatter atoms shine," referring to initial attempts to apply microwave spectroscopy on the trapped antihydrogen, an effort led by Prof. Michael Hayden of Simon Fraser University, and Prof. Walter Hardy of the University of British Columbia. This effort is the next step in determining the detailed atomic structure of antihydrogen, which could give new clues on why there is so much something, rather than a lot of nothing, in the universe.

Financial support for ALPHA-Canada and its members comes from NSERC (National Science and Engineering Research Council), NRC and TRIUMF, AIF (Alberta Ingenuity Fund), the Killam Trust, and FQRNT (Le Fonds québécois de la recherche sur la nature et les technologies).

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**For More Information**

ALPHA Collaboration website: http://alpha.web.cern.ch/alpha
CERN antimatter information: http://angelsanddemons.cern.ch/

**About TRIUMF**

TRIUMF is Canada's national laboratory for particle and nuclear physics. Located on the south campus of the University of British Columbia, TRIUMF is owned and operated as a joint venture by a consortium of the following Canadian universities, via a contribution through the National Research Council Canada: University of Alberta, University of British Columbia, University of Calgary, Carleton University, University of Guelph, University of Manitoba, McMaster University, Université de Montréal, Queen's University, University of Regina, Saint Mary's University, Simon Fraser University, University of Toronto, University of Victoria, York University.

**About ALPHA-Canada**

ALPHA is a collaboration of 42 physicists from 15 institutions from Canada, Brazil, Denmark, Israel, Japan, Sweden, UK, and the USA. ALPHA-Canada currently consists of 8 senior scientists, 5 graduate students, and several professional staff from 5 Canadian institutions. 15 out of 42 ALPHA co-authors in the reported work are with ALPHA-Canada: Andrea Gutierrez, Sarah Seif El Nasr, Walter Hardy (Univ. of British Columbia), Tim Friesen, Richard Hydomako, Robert Thompson (Univ. of Calgary), Mohammad Ashkezari, Michael Hayden (Simon Fraser Univ.), Scott Menary (York Univ.), Makoto Fujiwara, David Gill, Leonid Kurchaninov, Konstantin Olchanski, Art Olin, James Storey (TRIUMF). Spokesperson Makoto Fujiwara is also an adjunct professor in Calgary.

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