THE UNIVERSITY OF WINNIPEG

NEWS RELEASE

June 17, 2005
For Immediate Release

UWinnipeg Physicist Part of International Team that Finds Strange Quarks Influence Proton Structure

NEWPORT NEWS, VA—In research performed at the U.S. Department of Energy's Jefferson Lab, nuclear physicists have found that strange quarks do contribute to the structure of the proton. This result indicates that, just as previous experiments have hinted, strange quarks in the proton's quark-gluon sea contribute to a proton's properties. The result comes from work performed by the G-Zero collaboration, an international group of 108 physicists from 19 institutions, including The University of Winnipeg. UWinnipeg Assistant Professor in Physics Jeff Martin (PhD, Massachusetts Institute of Technology) was excited by the findings, presented at a Jefferson Lab physics seminar today.

“This is a groundbreaking experiment that has provided fundamental information about the inner workings of the atomic nucleus,” said University of Winnipeg Dean of Science Gabor Kunstatter. “We are particularly proud to have one of The University of Winnipeg's outstanding new Physics faculty members playing such a pivotal role in this world class research.”

“The results suggest that contribution of strange quarks to the proton’s charge and magnetism is non-zero,” Martin added. “The new data we have acquired will allow us to test models of how quarks and gluons make up the proton in a more detailed way than ever before.” Martin has been working to complete this research as a member of the collaboration since 1999, and joined The University of Winnipeg in October 2004.

Background Information from the Jefferson Lab:
Protons are found in the heart of all matter: the nucleus of the atom. Physicists have long known that protons are primarily built of particles called quarks, along with particles called gluons that bind the quarks together. There are three permanent quarks in the proton that come in two “flavours”: two “up” and one “down”. Up and down quarks are the lightest of the possible six flavours of quarks that appear to exist in the universe.

In addition to the proton’s three resident quarks, the peculiar rules of quantum mechanics allow other particles to appear from time to time. These ghostly particles usually vanish in a tiny fraction of a

second, but it's possible that they stay around long enough to influence the structure of the proton. Nuclear physicists set out to catch some of these ghostly particles in the act. They determined that the next-lightest quark, the "strange" quark, would be the most likely to have a visible effect.

Since the hydrogen nucleus consists of a single proton, G-Zero researchers sent a polarized beam of electrons into a hydrogen target. They then watched to see how many protons were "scattered," essentially knocked out of the target, by the electrons. Throughout the experiment, the researchers alternated the electron beam's polarization (spin).

What the researchers found was that strange quarks do contribute to the structure of the proton. In particular, the collaboration found that strange quarks contribute to the proton's electric and magnetic fields -- in other words, its charge distribution and magnetization.

However, by itself, the G-Zero result does not yet allow the researchers to separate the strange quark's contribution to the charge from its contribution to the magnetization. A future G-Zero run, coming up in December, will allow the researchers to separately determine the contribution of strange quarks to the charge and the magnetization, yielding even more fundamental information about the underlying structure of protons. This summer, two UWinnipeg undergraduate students are working for Martin for three months at the Jefferson Lab on preparations for the next G-Zero run.

G-Zero is a multi-year experimental program designed to measure, through the weak force, the strange quark contribution to proton structure. G-Zero was financed by the U.S. Department of Energy and the National Science Foundation. In addition, significant contributions of hardware and scientific/engineering humanpower were also made by CNRS in France and NSERC in Canada. To date, more than 100 scientists, 22 graduate students, and 19 undergraduate students have been involved with G-Zero. The results were presented at a public physics seminar titled "Strange Quark Contributions to Nucleon Structure? Results from the Forward G0 Experiment" June 17 at Jefferson Lab in Newport News, VA. A formal scientific paper will be submitted for review and publication on that day as well.

Jefferson Lab is managed and operated for the U.S. Department of Energy's Office of Science by the Southeastern Universities Research Association, a consortium of 61 universities in the southeast.
For more information or colour photos, please contact Linda Ware at 757.269.7689.

Located in the heart of downtown, The University of Winnipeg is a compact, diverse, multicultural academic community committed to access and excellence. Ranked by our graduates in Maclean's magazine University Graduate Survey (November 15, 2004) in the Top Ten of all Canadian universities when asked about their "Entire Educational Experience," UWinnipeg is home to more than 8,700 full- and part-time students.

- 30 -

For more information, please contact:
Ilana Simon, Communications Officer
The University of Winnipeg
T: 204.786.9930 C: 204.782.3279
i.simon@uwinnipeg.ca

Or

Physics Professor Dr. Jeff Martin
The University of Winnipeg
T: 204.786.9943
j.martin@uwinnipeg.ca