More than thirty years ago, Mark McConnell began his career at the University of New Hampshire as a doctoral candidate in physics. He graduated with his Ph.D. in 1987 and spent two years completing postdoctoral research in Munich, Germany as a visiting scientist at the Max Planck Institute for Extraterrestrial Physics. After completing his research, he returned home to the University of New Hampshire to begin work as a research scientist. Over the years, McConnell worked his way from research scientist to full professor and is now the chair of the physics department.

McConnell’s current research focuses on the development of a balloon-borne gamma ray telescope. “We are attempting a type of measurement that gives new insights into high energy phenomena in the Universe and provides training for the next generation of scientists,” he explains. The current experiment is known as the Gamma Ray Polarimeter Experiment, or GRAPE.

McConnell uses high altitude balloons to position detectors 130,000 feet above the Earth’s surface. At this height, they hover between the edge of space and the outermost limits of the Earth’s atmosphere. This allows for the collection of unhindered measurements of gamma radiation from space. McConnell is particularly interested in gamma-ray bursts and solar flares.

Gamma-ray bursts are flashes of intense gamma radiation that typically last for only a few seconds. They occur at random times and from random directions in the sky. They are some of the most distant objects in the Universe, thought to be signaling the formation of a black hole. By launching the balloon telescope to the outermost regions of the Earth’s atmosphere, McConnell is able to obtain important data about gamma-ray bursts and evaluate models for the creation of black holes.

Solar flares, in contrast, represent a more local source of high energy radiations. “In a way, my research encompasses the whole Universe,” McConnell jokes.

McConnell has used balloon-based experiments because of their cost efficiency and ability to provide the most in-depth learning experience and training for his students. “Scientific ballooning,” says McConnell, “offers students the full research experience because they can work on the design, build the hardware, conduct the experiments, and analyze the data within the timeframe of a Ph.D. thesis.” Currently, he is supervising two graduate students working on a balloon project that is set for launch from New Mexico in September 2014. This will be the second balloon flight of the GRAPE experiment; the first one took place in September 2011.

In the future, McConnell hopes to fly the GRAPE experiment from Antarctica, because, at certain times in the year, atmospheric conditions there permit much longer balloon flights than the 1 or 2 days that can be achieved in New Mexico. When launched from Antarctica, the balloons will be able to stay up in the atmosphere for approximately six weeks, and will circle around the pole repeatedly, coming back around every two weeks. McConnell hopes that two successful balloon flights from New Mexico will lay the groundwork for obtaining funding from NASA for the GRAPE launch in Antarctica.
In addition to his activities as a researcher and physics department chair, McConnell is involved on a personal level with several undergraduates, working with them in a variety of ways ranging from advising to research. He also enjoys giving public lectures at places such as the McAuliffe-Shepard Discover Center in Concord, NH, and recently spoke to a group of students as part of Project SMART, a summer institute at UNH that challenges, educates, and motivates talented high school students in science and mathematics while acquainting them with the environment and resources of the University as a place for higher education and research. The Project SMART students are planning to fly their own, much smaller, balloon experiments to similar altitudes as GRAPE using a small weather balloon.

(1) The GRAPE scientific payload inside its aluminum gondola.
(2) The GRAPE balloon payload shown during a power-up compatibility test on September 23, 2011 at the Columbia Scientific Balloon Facility in Ft. Sumner, NM.
(3) The GRAPE balloon is inflated at NASA's launch facility in Fort Sumner, New Mexico. At altitude the balloon expanded to a size large enough to hold a football field.
(4) Liftoff! With GRAPE's payload dangling above the horizon, the NASA balloon begins its rise to 130,000 feet or near space.

Photos by Mark McConnell, UNH Institute for the Study of Earth, Oceans, and Space

To learn more...
Mark McConnell's web page: http://astrophysics.sr.unh.edu/people/mcconnell/
From Soup to (GRAPE) Nuts
Scientific Ballooning at UNH
Recent Results and Future Plans for the Gamma Ray Polarimeter Experiment (GRAPE)

Story by Leslie Brown, with contributions from Michael Thompson and Lynnette Hentges. 7/15/14