A new look at the proton

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The HERMES experiment (HERA measurement of spin). This photo shows that the entire experiment is mounted on rails and can be moved out of the ring of the particle accelerator (HERA). At the bottom left of the photo a piece of tube from the accelerator can be seen through which the electrons move (to the right).

Dutch researcher Paul van der Nat investigated more than three million collisions between electrons and protons. In his PhD thesis he demonstrates -for the first time– that the spin contribution of quarks to the proton can be studied by examining collisions in which two particles (hadrons) are produced.

The spin of a particle can most easily be compared to the rotating movement of a spinning top.

In the HERMES experiment at the HERA particle accelerator in

Hamburg, physicists are investigating how the spin of protons can be explained by the characteristics of their building blocks: quarks and gluons.

Van der Nat investigated a method to measure the contribution of the spin of the quarks to the total spin of the proton, independent of the contribution of the spin of the gluons. For this a quark is shot out of the proton by an electron from the particle accelerator, as a result of which two hadrons are formed.

The direction and amount of motion of these two hadrons is accurately measured. This method, which Van der Nat applied for the first time, turned out to be successful.

Spin is a characteristic property of particles, just like matter and electrical charge. Spin was discovered in 1925, by the Dutch physicists Goudsmit and Uhlenbeck. In 1987, scientists at CERN in Geneva discovered that only a small fraction of the proton's spin is caused by the spin of its constituent quarks.

The HERMES experiment was subsequently set up to find this missing quantity of spin, and has been running since 1995. It is expected that spin will play an increasingly important role in many applications. The MRI scanner is a well-known example of an application in which the spin of protons plays a key role.

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