Nuclear Polarization of Molecular Hydrogen Recombined on a Non-metallic Surface.

Do the atoms sticking on a surface mantain their polarization? On this intriguing question related to the delicate interaction dynamics between an adsorbed atoms and the surface only a few measurements exist due to the difficulties in finding surface techniques sensitive enough.

We faced this problem in a quite unconventional way by using a particle physics detector measuring a well known high energy physics quantity. The quantity measured is the asymmetry between scattering polarized positrons from hydrogen nuclei with parallel or anti-parallel spin orientations. This process was first measured at very low temperatures where the contamination of molecular hydrogen was known to be very small. By raising the temperature of the storage cell in which the actual collisions take place, the fraction of molecular hydrogen was increased. By comparing the measured asymmetry at the two temperatures the polarization of the protons in molecular hydrogen could be deduced. As the hydrogen molecules are believed to result from interactions with hydrogen atoms on the cell surface, one obtain information on their polarization. In this way we have been able to measure for the first time the polarization of hydrogen atoms sitting on an insulating surface technically called *Drifilm*.

The result shows that opposed to what happens on a metallic surface, hydrogen atoms on an insulating surface preserve their polarization for long times (tens of second). This result is remarkable as similar measurements on metallic surfaces gave much shorter depolarization times. It is also noted that this measurement is of relevance for the analysis of high-energy physics data as well, since they are needed for the evaluation of the correction factors for various subsets of data collected.