Antiprotonic Atom Formation and Spectroscopy -
ASACUSA experiment at CERN-AD

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ABSTRACT

The ASACUSA collaboration was formed in 1997 after the Antiproton Decelerator (AD) at CERN was approved, by members of the previous PS194, PS200, and PS205 collaborations working at CERN-LEAR. This was natural since the interest of the groups (study of atomic collision and formation processes with low-energy antiprotons and laser spectroscopy of antiprotonic helium “atomules”) are closely related. The name of ASACUSA (Atomic Spectroscopy And Collisions Using Cold Antiprotons) reflects the combined research theme of the new collaboration.

In the first year of the AD (1999) we plan to extend the laser and microwave spectroscopy experiments on antiprotonic helium atomcules using the 5.3 MeV AD beam directly. In the year 2000 a RFQ will be installed at the AD to decelerate the p to 20-100 keV. Using this beam, energy loss experiments in low-density matter and the study of the primordial \((n, l)\) distribution of antiprotonic helium will be possible. In the same year, a penning trap for antiproton capture and cooling will be placed after the RFQ. We are planning to extract ultra-low energy antiprotons (10 eV - 10 keV kinetic energy) in a beam for studies of exotic atom formation, energy loss and ionization measurements. If antiprotonic atoms like protonium or others can be formed in a collision-free environment using this low-energy antiproton beam, laser spectroscopy measurements will also become possible for those atoms which are too short-lived if produced in dense media.