Positron Interactions with Targets of Fundamental Interest

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Despite a large body of relatively recent work, both experimental and theoretical (see, for instance, [1, 2]), on low energy positron scattering processes, there are a number of interesting interactions that have not been investigated. This talk will explore recent work at the Australian National University, on positron scattering from neon and ethane.

Measurements are made using a Surko trap and beam system, which produces a pulsed positron beam with an energy spread of approximately 50 meV [3]. The energy of the beam can be tuned between 0 and 200eV, and is magnetically confined using a 500 gauss axial magnetic field. Using techniques developed at the University of California, San Diego [4], we can take advantage of the magnetic confinement to measure a wide range of scattering processes.

While there have been many measurements of total cross sections for positron scattering from noble gas targets, there are relatively few differential cross section (DCS) measurements. In particular, there is only one measurement of DCS for positron scattering from neon [5], and these are not absolute and over a restricted energy range. In this talk, we will present recent measurements of the positron-neon elastic DCS, at energies from 1eV to 40 eV, and discuss the comparison to the most recent theoretical calculations. Despite generally good agreement at the TCS level, there remain discrepancies between the experimental and theoretical DCS. We will also present the first measurements of state selective excitation for the neon electronic states.

In addition to the noble gases, there is significant interest in the low energy interactions of positrons with molecules. In particular, there has been a wide range of measurements of positron annihilation which demonstrate the presence of vibrational feschbach resonances (VFR) [6]. In the second part of this talk, we will outline recent work aimed at exploring the interaction of these resonances with the excitation of vibrational modes of these molecules. The ultimate aim is to shed further light on the formation and decay mechanisms of the VFRs.

References

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