Resonances in Low-energy Positron Scattering from Atoms and Molecules [+]

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Although ubiquitous in electron scattering, resonances in elastic and inelastic cross sections for positrons have been more elusive. This paper will discuss recent progress made using a high-resolution (i.e. 25 meV, FWHM) positron beam [1] to search for comparable resonances in low energy positron scattering from atoms and molecules.

This work was done using a beam of positrons extruded from a Penning-Malmberg trap with a well-defined energy. The positrons are magnetically guided through a gas cell, and the intensity and energy distribution of the transmitted beam is measured using a retarding potential analyzer. A new analysis technique allows us to distinguish elastic and inelastic scattering processes by exploiting our ability to have different magnetic field strengths in the scattering and analysis regions. [2]

In this talk, I will discuss the current status of resonance searches in low energy positron scattering. To date we have observed no sharp resonance in positron total cross sections [3], even though their existence has been predicted by a number of calculations. [4] However, we have observed sharp onsets at threshold in several inelastic cross sections. A sharp rise near threshold is observed in the vibrational excitation cross sections of all of the molecules we have studied including CO, CO_2, and H_2. [5] These sharp onsets are also present in some of the electronic excitation measurements. In particular, in N_2 there is a peak in the positron scattering near threshold that is not present in comparable electron data. [6]

An increase in our beam resolution and improved ability to look at lower energy positron interactions would help us develop a clearer picture of this and other resonance behavior. Some improvements to the current setup towards this goal will be discussed. Also other likely candidates for resonances will be discussed, including a possible resonance in the total cross section at the threshold of Ps(n=2) state. [7]

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