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Trends in Positron Scattering from Biomolecules

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Synopsis We present recent measurements of the total scattering and positronium formation cross sections for Uracil, THF, 3H-THF and make comparisons with previous work and recent results; H_2O and Pyrimidine.

We present new measurements of positron scattering from a series of biologically relevant molecules; Uracil ($C_4H_4N_2O_2$), Tetrahydrofuran or THF (C_4H_8O) and 3-hydroxy-THF ($C_4H_8O_2$). These measurements were taken using the high resolution, low energy positron beam at the Australian National University. The energy of the magnetically confined positron beam can be tuned between 1 and 200 eV, with an energy resolution typically between 60 to 100 meV. The measurements include absolute total scattering, positronium formation, and differential cross sections. One of the ultimate aims of this work is to combine state-of-the-art measurements of positron interactions with bio-molecules for use in models of positron transport in biological systems. A comparison of the current total scattering cross section results without associated uncertainties are shown in figure 1.

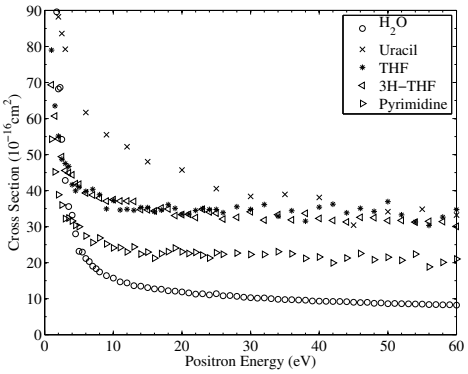

Figure 1. Present results for total scattering of positrons from H_2O (○) [1] Uracil (x), THF (*), 3H-THF (◁), and Pyrimidine (▷).

Differential cross section (DCS) measurements were also taken. An example of this is seen in figure 2 for THF. A common feature of the DCS for all energies we measured up to 6 eV is that they all rise sharply in the forward direction. This is expected due to the relatively large dipole polarizability and permanent dipole moment of THF, which results in enhanced long-range interactions and stronger forward angle scattering at these energies. Strong forward peaking is also observed in the elastic DCS. The general qualitative and quantitative agreement between the electron and positron data agreement suggests that the scattering dynamics at these lower energies are significantly governed by these dipole effects, thus making the cross sections rather insensitive to the sign of the charge of the projectile.

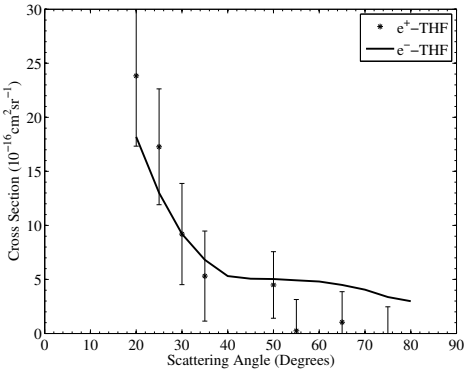

Figure 2. Present results for differential scattering of positrons from THF at 6 eV. Comparison is made to electron scattering data [2].

References

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