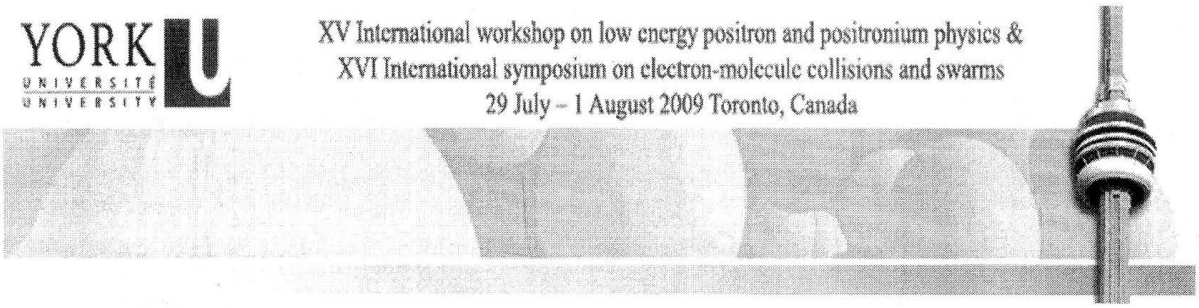

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XV INTERNATIONAL WORKSHOP ON LOW ENERGY POSITRON AND POSITRONIUM PHYSICS

PROGRAMME AND BOOK OF ABSTRACTS

Energy scale determination and partitioning in positron total cross sections measurements

Grzegorz Karwasz[1)], Roberto S. Brusa[2)]

[1)]*Institute of Physics, University Nicolaus Copernicus, 87100 Toruń, Poland*
[2)] *Dipartimento di Fisica, Universita' di Trento, 38010 Trento, Italy*

Measurements of total cross sections rarely extend down to sub-eV energy range. This was the case of Detroit experiment in its early version, using boron moderator [1] and the case of the more recent Trento apparatus [2] using single crystal 1 μm thick tungsten moderator [3]. Out of that latter apparatus two series of data exist: those performed in 2004-2005 [4-7] and the more recent [8,9]. Gases as benzene, cyclohexane and aniline were measured by both groups [4-5, 8], but they apparently differ, by some 20-30% in the low energy range.

In collision experiments the absolute energy scale depends on contact potentials between the projectile source and the scattering cell, see e.g. [10]. In our previous papers [7, 11, 12] we proposed several methods of determining the absolute energy scale in positron measurements. They included the retarding field analysis [11], energy resolution callibtration on electron-N_2 scattering [12], and the most thoroughly – determination of the positronium formation threshold in N_2 and Ar [7]. All those checks gave energy calibration value of 2.4±0.1 eV with the energy resolution of about 0.1 eV.

In turn, the energy calibration procedures are not clear in papers [8,9] and the declared the energy resolution is of "slightly less than 0.3 eV" [13]. Moreover, the renewed Trento group quotes total cross sections down to as little as 0.1 eV [8] what would be meaningless. By comparison of the measurements in benzene, aniline and cyclohexane we conclude that all different sets of data, including those of Suoeka [13] would practically coincide if Zecca's energy scale [8] is shifted by +0,2 eV.

We come to the same conclusion , if we compare the recent experimental data [8] for the formic acid (HCOOH) with the calculation by Lima and Bettega [8]. The theory, in particular for polar molecules where the differential cross sections are strongly peaked in the limit of zero angle, hardly can overestimate the total cross section. The data by Zecca et al. differing from the theory by 50% at 0.5 eV would coincide with the latter if the energy calibration would again is shifted by +0.2 eV.

A correct determination of the energy scale allows to attribute the faint structures in benzene and aniline, visible in both sets of data [5, 8] to the positronium-formation cross section. Subtracting the modified-effective range fit [14] from the experimental total cross section yields in benzene a maximum cross section of about $5x10^{-20}m^2$, compatible with the direct measurement by Suoeka [13]. Details will be given at the Worskshop.

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