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Positronium formation in gases and liquids

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Development of medical imaging techniques based on positron annihilation [1] triggered a renewed interest in fundamental studies of positron scattering by organic molecules. Such studies require the complementary information from different research fields. On the one hand an accurate experimental characterization of positron behavior in condensed matter is necessary in order to grasp a main features of positron collective interaction with dense molecular environment. On the other hand the knowledge about the basic interactions occurring on molecular scale over a wide energy range is indispensible for modeling purposes. In particular the scattering cross section, measured in the gas-phase conditions, are required as inputs for modeling codes [2]. In this context, experimental and theoretical total positron scattering and positronium formation cross sections from organic molecules are necessary.

The aim of this work is twofold. Firstly, we re-discuss main problems related with the determination of positron scattering and positronium formation cross-sections for gas-phase molecules [3]. Examples of benzene, cyclohexane and methanol are given. Some semi-empirical analysis of scattering cross-sections below Ps formation is presented [4]. Secondly, we report the positron lifetime measurements in liquid-phase of these three molecules as a function of both temperature and air content. Air presence changes significantly the value of the third component; surprisingly we observed little influence on the intensity of this component.

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