

University of Wollongong

Research Online

Faculty of Engineering and Information
Sciences - Papers: Part A

Faculty of Engineering and Information
Sciences

2014

Low-energy positron and electron scattering from tetrahydrofuran and 3-hydroxy-tetrahydrofuran

James P. Sullivan

Australian National University, james.sullivan@anu.edu.au

Luca Chiari

Australian National University, luca.chiari@flinders.edu.au

Emma Anderson

Australian National University

Wade Tattersall

Australian National University

Prasanga Palihawadana

Australian National University

See next page for additional authors

Follow this and additional works at: <https://ro.uow.edu.au/eispapers>

 Part of the [Engineering Commons](#), and the [Science and Technology Studies Commons](#)

Recommended Citation

Sullivan, James P.; Chiari, Luca; Anderson, Emma; Tattersall, Wade; Palihawadana, Prasanga; Machacek, J R.; Makochekanwa, Casten; McEachran, R P; Buckman, Stephen J.; Brunger, M J.; Garcia, Gustavo; and Blanco, Francisco, "Low-energy positron and electron scattering from tetrahydrofuran and 3-hydroxy-tetrahydrofuran" (2014). *Faculty of Engineering and Information Sciences - Papers: Part A*. 6655. <https://ro.uow.edu.au/eispapers/6655>

Research Online is the open access institutional repository for the University of Wollongong. For further information contact the UOW Library: research-pubs@uow.edu.au

Low-energy positron and electron scattering from tetrahydrofuran and 3-hydroxy-tetrahydrofuran

Abstract

We present new cross section results from a joint experimental and theoretical investigation into low-energy positron and electron scattering from two targets of biological interest, namely tetrahydrofuran and 3-hydroxy-tetrahydrofuran. We compare and discuss the total, elastic and inelastic cross sections for these species in the light of potential positron and electron-induced damage in biomolecular systems.

Keywords

scattering, electron, tetrahydrofuran, positron, hydroxy, energy, low, 3

Disciplines

Engineering | Science and Technology Studies

Publication Details

Sullivan, J. P., Chiari, L., Anderson, E., Tattersall, W., Palihawadana, P., Machacek, J. R., Makochekanwa, C., McEachran, R. P., Buckman, S. J., Brunger, M. J., Garcia Gomez-Tejedor, G. & Blanco, F. (2014). Low-energy positron and electron scattering from tetrahydrofuran and 3-hydroxy-tetrahydrofuran. *Journal of Physics: Conference Series*, 488 (7), 072007-1.

Authors

James P. Sullivan, Luca Chiari, Emma Anderson, Wade Tattersall, Prasanga Palihawadana, J R. Machacek, Casten Makochekanwa, R P. McEachran, Stephen J. Buckman, M J. Brunger, Gustavo Garcia, and Francisco Blanco

Low-energy positron and electron scattering from tetrahydrofuran and 3-hydroxy-tetrahydrofuran

This content has been downloaded from IOPscience. Please scroll down to see the full text.

2014 J. Phys.: Conf. Ser. 488 072007

(<http://iopscience.iop.org/1742-6596/488/7/072007>)

View [the table of contents for this issue](#), or go to the [journal homepage](#) for more

Download details:

IP Address: 130.130.37.85

This content was downloaded on 11/01/2015 at 22:09

Please note that [terms and conditions apply](#).

Low-energy positron and electron scattering from tetrahydrofuran and 3-hydroxy-tetrahydrofuran

J. P. Sullivan^{* 1}, L. Chiari^{†*}, E. Anderson^{*}, W. Tattersall^{*‡}, P. Palihawadana^{*}, J. R. Machacek^{*},
C. Makochekanwa^{*}, R. P. McEachran^{*}, S. J. Buckman^{*†}, M. J. Brunger^{†,†}, G. Garcia^{#, &}
and F. Blanco[^]

^{*} ARC Centre for Antimatter-Matter Studies (CAMS), Research School of Physics and Engineering, The Australian National University, Canberra ACT, Australia

[†] ARC CAMS, School of Chemical and Physical Sciences, Flinders University, Adelaide SA, Australia

[‡] ARC CAMS, School of Engineering and Physical Sciences, James Cook University, Townsville QLD, Australia

⁺ Institute of Mathematical Sciences, University of Malaya, Kuala Lumpur, Malaysia

[#] Instituto de Física Fundamental, Consejo Superior de Investigaciones Científicas, Madrid, Spain

[&] Centre for Medical Radiation Physics, University of Wollongong, Wollongong NSW, Australia

[^] Departamento de Física Atómica, Molecular y Nuclear, Universidad Complutense de Madrid, Madrid, Spain

Synopsis We present new cross section results from a joint experimental and theoretical investigation into low-energy positron and electron scattering from two targets of biological interest, namely tetrahydrofuran and 3-hydroxy-tetrahydrofuran. We compare and discuss the total, elastic and inelastic cross sections for these species in the light of potential positron and electron-induced damage in biomolecular systems.

We present recently measured and computed cross sections for low-energy positron collisions with the structurally related molecules tetrahydrofuran (THF) [1] and 3-hydroxy-tetrahydrofuran (3H-THF) [2]. Those two species represent suitable models for the sugar rings contained in the phosphate-deoxyribose backbone structure of the nucleic acids [3, 4]. As the knowledge of the impact cross sections is essential for charged-particle track simulations, studying those compounds can assist us in shedding more light on the effects of positron and electron-induced damage in biological media.

Total, positronium formation, elastic differential and inelastic integral cross sections have been measured at selected energies in the range 1-190 eV using the buffer-gas trap and positron beam spectrometer at the Australian National University [5] with an energy resolution of 60-100 meV.

Total, inelastic and elastic integral, as well as elastic differential cross sections have also been computed at energies between 1 and 1000 eV within the Independent Atom Model and using the Screening Corrected Additivity Rule formalism [6]. In addition, electron-impact cross sections have also been calculated in order to explore the different role that positrons and electrons play in the low-energy scattering dynamics for those species.

¹ E-mail: james.sullivan@anu.edu.au

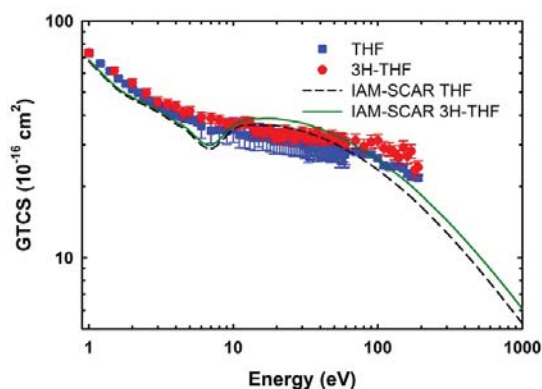


Figure 1. Comparison of the present experimental and theoretical total cross sections for positron scattering from THF and 3H-THF.

We also compare the present cross sections for THF and 3H-THF in order to examine how small changes in the molecular structure (that can lead to quite different physico-chemical properties) can affect the scattering process for those systems.

References

- [1] L Chiari *et al* 2013 *J. Chem. Phys.* **138** 074301
- [2] L Chiari *et al* 2013 *J. Chem. Phys.* **138** 074302
- [3] M Lepage *et al* 1998 *J. Chem. Phys.* **109** 5980
- [4] B Thiemer *et al* 2003 *Arch. Microbiol.* **179** 266
- [5] J P Sullivan *et al* 2008 *Rev. Sci. Instrum.* **79** 113105
- [6] L Chiari *et al* 2012 *J. Phys. B* **45** 215206

