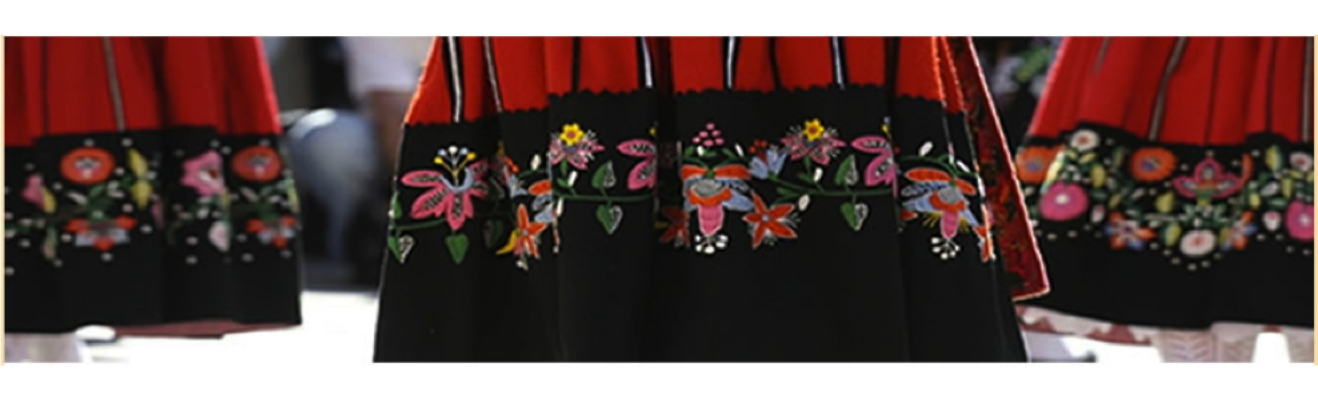
ESCAMPIG 2012
Viana do Castelo



XXI Europhysics Conference on the Atomic and Molecular Physics of Ionized Gases

Tuesday 10 July to Saturday 14 July 2012

at Castelo de Santiago da Barra
Viana do Castelo, Portugal
http://escampig2012.ist.utl.pt

PROCEEDINGS

Edited by
Pedro G. C. Almeida, Luís L. Alves and Vasco Guerra

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Foreword

This document contains the invited and contributed papers presented at the XXI Europhysics Conference on the Atomic and Molecular Physics of Ionized Gases. The conference was held on July 10-14, 2012, in Viana do Castelo, Portugal. The final papers were selected by the International Scientific Committee from 383 submitted contributions, coming from all inhabited continents on Earth. The countries represented span from Brazil to China and Australia, in a significant enlargement in diversity of the ESCAMPIG attendees.

The ESCAMPIG is an international conference being celebrated since 1973. It is now a biennial conference of the European Physical Society (EPS). The wide variety of conference topics on basic and applied plasma science spans from atomic and molecular processes in plasmas and plasma-surface interaction to self-organization in plasmas and to the new research lines with low- and high-pressure plasma sources.

The conference programme included two workshops: “plasmas for sustainable environment” and “air plasma chemistry.” The latter was devoted to honour the memory of Dr. Boris F. Gordiets, who passed away early this year. Boris was an outstanding scientist who gave major contributions to the field of plasma kinetics, including the celebrated vibrational distribution function that carries his name. His books remain ultimate references on the kinetics of molecular gases. I met Boris Gordiets while I was still a PhD student, an encounter I vividly remember. I later had the privilege of working with him. His ideas and insight keep inspiring me today.

I heartily thank all members of the Local Organizing Committee for their thoughtful participation, constructive remarks and invaluable assistance. Dr. Luís L. Alves has been with me from the first day and acted as a real co-chair of this conference. Dr. Pedro Almeida gave a priceless help by preparing on his own these conference proceedings. All the other members of the LOC contributed decisively: Dr. Carlos Daniel Pintassilgo, Dr. Mário Lino da Silva, Dr. Luís Marques, Mr. Edgar Felizardo, Mr. André Janeco, Mr. Rafael Saavedra and Mr. Miguel Santos. To all my gratitude.

Finally, I am indebted to our sponsors: EPS, IOP/Plasma Sources Science and Technology, Fundação para a Ciência e Tecnologia, Universidade Técnica de Lisboa, Instituto Superior Técnico and its Physics Department, Câmara Municipal de Viana do Castelo, Câmara Municipal de Guimarães, the wine producers Solar de Merufe, Palácio da Brejoeira and Comissão de Viticultura da Região dos Vinhos Verdes. A special word is due to the Entidade Regional de Turismo do Porto e Norte de Portugal, in the persons of Dr. Júlio Meirinhos and Mr. Leonel Franco, who in practice played the role of the LOC member at the conference site.

Vasco Guerra
Chair of the LOC
July 2012

ESCAMPIG XXI conference proceedings

By author:

By topic:

By type:

ESCAMPIG XXI conference programme

Tuesday, July 10th

16:30-18:30 Registration, castelo de Santiago da barra

19:00-20:00 Welcome reception, convento de S. Domingos

Wednesday, July 11th

8:45-9:15 Opening

9:15-10:45 Chairs: Juergen Meichsner and Raoul Franklin

GL.1 C. M. Ferreira, “Microwave driven air-water plasmas”

TL.1 Jan Benedikt, “Plasma chemistry in the effluent of a He/O2 microplasma jet: the role of VUV photons”

HT.1 Nikolay Dyatko, “Experimental and theoretical study of the influence of nitrogen admixture on characteristics of dc glow discharge in rare gases at intermediate pressures”

10:45-11:15 Coffee break

11:15-13:00 Chairs: Giorgio Dilecce and Mike Bowden

GL.2 Nikolai Trushkin, “Steady-state and pulsed-periodical regimes for generation of non-thermal plasma jets at atmospheric pressure”

TL.2 Ester Marotta, “Decomposition of mixtures of organic compounds in atmospheric plasma”

TL.3 Francisco Tabares, “Application of nitrogen-containing plasmas to Fusion Plasma Research”

13:00-14:30 Lunch

14:30-16:15 Poster session 1

16:15-16:45 Coffee break

16:45-19:00 Chairs: Antoine Rousseau and Elena Tatarova

HT.2 Uroš Cvelbar, “Plasma reshaping carbon: The role of plasma species in surface interactions with carbon”

Workshop 1: Plasmas for sustainable environment

W1.1 Claudia C. Luhrs, "Microwave Plasma Produced Materials For Energy Applications"

W1.2 Jayr Amorim, "Ozone Measurements by Absorption Spectroscopy Applying Dielectric Barrier Discharges at Atmospheric Pressure for Sugarcane Bagasse Treatment"

W1.3 Evgenia Benova, "Cylindrical and coaxial surface-wave-sustained plasma for environmental applications"

W1.4 María Dolores Calzada, Hydrogen production from ethanol decomposition by a surface wave discharge at atmospheric pressure"

W1.5 Igor Kossyi, "Multispark discharge in water as a method of environmental sustainability problems solution"

W1.6 Richard Engeln, "Plasma-assisted CO2 processing for energy storage"

W1.7 Xavier Duten, "Diphasic process combining a fluidized catalytic bed and a plasma at atmospheric pressure for the degradation of volatile organic compounds"

19:00-19:30 Wine tasting, castelo de Santiago da Barra

Thursday, July 12th

9:00-10:45 Chairs: Štefan Matej•ik and Annemie Bogaerts

GL.3 Roberto Celiberto, “Electron-molecule collision processes in non-equilibrium molecular plasmas”

TL.4 Olivier Guaitella, “N and O atoms adsorbed under plasma exposure: a model system to investigate surface reactivity”

TL.5 João Santos Sousa, “Cold atmospheric pressure plasma jets as sources of reactive oxygen species for biomedical applications”

10:45-11:15 Coffee break

11:15-13:00 Chairs: Peter Hartmann and Yuri Akishev

GL.4 Michael Bonitz, “Complex plasmas - a laboratory for self-organization”

TL.6 Thierry Callegari, “Generation, annihilation and motion of self-organized filaments in dielectric barrier discharges”

HT.3 Pedro Almeida, “Self-organization as an intrinsic feature of DC glow microdischarges: modelling appearance of different spot patterns”

HT.4 Tomas Hoder, “Comparison of pulsed and sinusoidal operated barrier discharges”

13:00-14:30 Lunch

14:30-16:15 Poster session 2

16:15-16:45 Coffee break

16:15-19:00 (Fabrizio Esposito and Mário Lino da Silva)

HT.5 Arnaud Bultel and Julien Annaloro, “Elaboration of collisional-radiative models: illustration and results for flows related to planetary entry situations into Earth and Mars atmospheres”

Workshop Boris F. Gordiets: Air plasma chemistry

W2.1 Carlos Matos Ferreira and Mario Capitelli, “50 Years of Non-Equilibrium Kinetics in Laser Physics, Geophysics and Plasma Chemistry: a Tribute to Boris Gordiets”

W2.2 António Varandas, “Recent progress on accurate ab initio-based potentials and dynamics: atmospheric NxOy triatomic systems and beyond”

W2.3 Annarita Laricchiuta, “Electron-impact excitation cross sections for air kinetics”

W2.4 Fabrizio Esposito, “Rovibrationally detailed cross sections of atom-diatom collisions concerning air species”

W2.5 Mário Lino da Silva, •
“Modeling of diatom-diatom collisions using the Forced Harmonic Oscillator method, and application to high temperature kinetics applications”

W2.6 Christophe Laux, •
“Radiative transition probabilities and electron-impact excitation cross-sections for the VUV systems of N_2”

20:00-23:30 Conference dinner, Quinta de S. João

Friday, July 13th

9:00-10:45 Chairs: Francisco Gordillo-Vázquez and Juergen Meichsner

GL.5 Ute Ebert, “Thunderstorms as electron accelerators and the discharge zoo above the clouds”

GL.6 Antoine Rousseau, Crookes Prize Lecture, “Streamers and discharges at liquid and solid interfaces”

HT.6 Julian Schulze, “Ionization by drift and ambipolar electric fields in electronegative capacitive radio frequency plasmas”

10:45-11:15 Coffee break

14:30-16:15 Poster session 3

13:00-14:30 Lunch

14:30-19:30 Excursion, Guimarães

Saturday, July 14th

9:00-10:45 Chairs: Stéphane Pasquiers and Vasco Guerra

GL.7 Kostya Ostrikov, “Small energy for small things: plasma nanoscience for a sustainable future”

TL.7 Bogdana Mitu, “Plasma deposition of carbon-based materials: diagnostic studies”

TL.8 Frantisek Krcma, “Generation of pin hole discharges in liquids”

10:45-11:15 Coffee break

11:15-12:30 Chairs: Dragana Maric and Gheorghe Dinescu

HT.7 Mark J. Kushner, “Control of Electron, Ion and Photon Distributions in Low Pressure Plasmas Using Pulsed Power”

HT.8 Masaru Hori, “High-speed synthesis and crystalinity control of nanographene using inliquid plasma in alcohol”

GL.8 William G. Graham, “Plasmas in Liquids and their Applications”

12:30-13:00 Closing

Author(s)	Title	Program number
Jaime de Urquijo, José Luis Hernández-Ávila, Eduardo Basurto, Gerardo Ruiz-Vargas and Antonio Juárez	Effective ionization coefficients and limiting field strength of SF6-N2O and CF3I-SF6-N2 mixtures	P1.1.1
Toshitsugu Gunji, Satoru Iizuka	Conversion of CO2 to methane by a low-pressure hollow-cathode discharge	P1.1.2
Miguel Jiménez-Redondo, Esther Carrasco, Víctor J. Herrero, Isabel Tanarro	Energy distributions of neutrals and ions in H2/D2 hollow cathode discharges	P1.1.3
V. Laporta, J. Tennyson, R. Celiberto	Resonant vibration excitation cross sections and rate coefficients for electron–CO and CO2 scattering	P1.1.4
Koichi Sasaki and Renge Asakawa	Optical emission intensity of molecular hydrogen in a recombining hydrogen plasma	P1.1.5
A. Luque, F. J. Gordillo-Vázquez	Mesospheric electric breakdown and delayed sprite ignition caused by associative electron detachment	P1.1.6
Esther Carrasco, Víctor J. Herrero, Isabel Tanarro	Time resolved diagnostics and kinetic modeling of the ignition transient of a H2+10%N2 square wave modulated hollow cathode discharge	P1.1.7
Ž. Nikitović , V. Stojanović and Z. Lj. Petrović	Modeling in Ar/H2 discharge	P1.1.8
C. Foissac, J. Krištof, A. Annušová, P. Veis and P. Supiot	Kinetics of N2(B3Pg) and N2(C3Pu) states in N2-Ar discharges sustained by a RF helical coupling device	P1.1.9
A. Annušová, C. Foissac, J. Krištof, P. Veis and P. Supiot	Vibrational Distribution Function of N2(C3Pu, v') state in N2-Ar discharge created by a RF helical coupling device	P1.1.10
D. A. Little, J. Tennyson	Electron Collisions with N2+: Temperature Dependent Processes	P1.1.11
S. Lovascio, N. Blin-Simiand, L. Magne, F. Jorand, P. Jeanney, S. Pasquiers	Ethanol decomposition in Air Dielectric Barrier Discharges: experimental study and kinetic modeling	P1.1.12
E. Benova, P. Marinova, V. Marchev, M. Atanasova, Tz. Petrova	Effect of gas discharge conditions on Argon surface-wave-sustained plasma kinetics	P1.1.13
K. Omiya, I.M. Rusinov, S. Suzuki, H. Itoh	Temperature dependence of ozone loss rate	P1.1.15
Luis Alves and The Lxcat Team	Status report on the LXCat project	P1.1.16
S. Béchu, A. Soum-Glaude, A. Bès, P. Svarnas, M. Bacal, A. Lacoste	Surface mechanisms investigation for negative ion production	P2.1.1
C. Küllig, K. Dittmann and J. Meichsner	High and low electronegativity mode in cc-rf oxygen plasma	P2.1.2
S. Suzuki, Y. Koizumi, H.Itoh	Collisional quenching rate coefficient of N2(A3Σ+u) by xylene	P2.1.3
Jelena Maljkovic, F Blanco, Gustavo Garcia, Bratislav Marinkovic and Aleksandar Milosavljevic	Relative differential cross sections for elastic electron scattering by furan	P2.1.4
V. Stojanović, Z. M. Raspopović, J. Jovanović, Ž. Nikitović and Z. Lj. Petrović	Detachment rate for negative ions in Ar/BF3 discharges	P2.1.5
G. Bandelow, R. Schneider, J. Meichsner	Modeling and sensitivity studies of cc-rf CF4 plasma	P2.1.6
H. Terças, J. T. Mendonça and V. Guerra	Classical rotons due to light fluctuation and plasma-like effects in cold atomic traps	P2.1.7
Alexandre Chicheportiche, Bruno Lepetit, Malika Benhenni, Florent Xavier Gadéa and Mohammed Yousfi	Integral cross sections of He+/He and He2+/He interaction systems for optimization of low temperature plasma sources for biomedical uses	P2.1.8
M. Asandulesa, I. Topala, Y. M. Legrand, M. Dobromir, N. Dumitrascu	About the polymerization of aromatic compounds under atmospheric plasma conditions	P2.1.9
B. Lopez, M. Lino da Silva, V. Guerra, J. Loureiro	Coupled Hydrodynamic/State-Specific High-Temperature Modeling of Nitrogen Vibrational Excitation and Dissociation	P2.1.10
H. Latappy, O. Koeta, N. Blin-Simiand, M. Heninger, H. Mestdagh, S. Pasquiers	Real-time analysis of acetaldehyde conversion by dielectric barrier discharge	P2.1.11
S. Nguyen-Kuok, S. Hassanpour, A. Ageev	Quantum-mechanical calculation of electron scattering on the atoms in the argon plasma	P2.1.12
J. Gregório and L. C. Pitchford	Swarm parameters in Cl2/rare gas mixtures	P2.1.13
M. Klas, Š. Matejčík	Electrical Breakdown in Water Vapor at micrometer separations	P2.1.15
Lucio Isola, Maia Lopez, Javier Cruceño and Bernardo Gómez	Measure of the Ar(1sy) state densities by OES in Ar-N2 discharges	P2.1.16
Aleksander Drenik, Alenka Vesel and Miran Mozetič	Probability of Heterogeneous Recombination of Atomic Hydrogen on Fine-Grain Graphite Surface	P2.1.17
R. Plašil, T. Kotrík, P. Dohnal, P. Rubovič, Š. Roučka, S. Opanasiuk, J. Glosík	Collisional radiative recombination Ar+ + e– + e– in low temperature plasma	P2.1.18
Namjun Kang, Soo-Ghee Oh, André Ricard and Lee Minwook	Detection of N2(A) metastable molecules in the N2 RF afterglows	P2.1.19
Ouya Koeta, Stéphane Pasquiers, Nicole Blin-Simiand, Abdouraman Bary and François Jorand	Production of methyl nitrate and PAN following the decomposition of acetaldehyde in atmospheric gases	P2.1.20
A. Bekstein, J. de Urquijo, F. J. Gordillo-Vázquez, G. Ruiz-Vargas	Influence of pressure on the formation of negative ions in water vapour	P3.1.1
M. Danko, J. Országh, A. Ribar, Š. Matejčík	Electron Induced Emission of Methane	P3.1.2
A. Bekstein, C. Villavicencio, J. Figueroa, J. de Urquijo	Electron detachment in N2O	P3.1.3
Charles Klett, Zixian Jia, Sylvain Touchard, Arlette Vega, Michael Redolfi, Khaled Hassouni and Xavier Duten	Oxidation of an acetaldehyde/acetylene equimolar mixture by an atmospheric non-thermal plasma discharge	P3.1.4
E. A. D. Carbone, J. M. Palomares, S. Hübner, J.J.A.M. van der Mullen	Unravelling in situ atomic and molecular kinetics by LCIF and Thomson scattering	P3.1.6
T.T.J. Clevis, S. Nijdam, U. Ebert	Slow decay of radiation after a pulsed streamer discharge in pure nitrogen	P3.1.7
I. Zymak, M. Hejduk, D. Mulin, R. Plašil, D. Gerlich and J. Glosík	Ternary association of H+ ions with H2: Experiments with normal and para-enriched hydrogen at 11 K	P3.1.8
Mario Lino Da Silva, Dzmitry Tsyhanou, Vasco Guerra and Jorge Loureiro	An Improved Kinetic Model for Highly Ionized N2-CH4 Shocked Flows	P3.1.9
W.Kamiński, J.Košik, P.Warda	Influence of neon and argon admixtures on laser generation conditions of krypton ion lasers	P3.1.10
A. Laricchiuta, G. Colonna, E. Bisceglie and M. Capitelli	Electron-impact excitation cross sections for air kinetics	WS2.3
F. Esposito, I. Armenise	Rovibrationally detailed cross sections of atom-diatom collisions concerning air species	WS2.4

Relative differential cross sections for elastic electron scattering by furan

J. B. Maljković[a], F. Blanco[b], G. García[c,d], B. P. Marinković[a] and A. R. Milosavljević[a*]

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Relative differential cross sections for elastic electron scattering from gaseous furan (C_4H_4O) have been determined both experimentally and theoretically. The measurements were performed using a cross beam technique, for the incident energies of 50, 75 and 100 eV and scattering angles from 20º to 110º. The calculations are based on a corrected form of the independent-atom method, known as the SCAR (Screen Corrected Additivity Rule) procedure.

Furan is the simplest five-membered heterocycle molecule and it may serve as a prototype of furanose units in biomolecules. The work of Boudaiffa et al. [1] has shown that secondary low-energy electrons can cause significant, energy-dependent single and double-strand breaks in DNA. Thus, the investigation of electron interaction with molecules that are analogue to DNA building blocks may be important for radiation damage research [2-5]. Very recently, Khakoo et al. [6] have published both experimental and theoretical results on low energy (≤ 50 eV) elastic electron scattering from furan molecule. Also, Szmytkowski et al. [7] measured the total cross section over energies from 0.6 eV to 400 eV using a linear electron transmission method and calculated integral elastic and ionization cross sections up to 4 keV. Electron collisions with furan have been theoretically investigated by Bettega and Limma [8], as well. In the present contribution, preliminary relative differential cross sections (DCSs) for elastic electron scattering from furan molecule are presented at 50, 75 and 100 eV.

Our experimental apparatus has been described in previous papers [3,9]. The experimental set-up consists of an electron gun, a double cylindrical mirror energy analyzer and a channel electron multiplier as detector. The base pressure was about $4x10^{-7}$ mbar, while the working pressure was in the range $(2\text{-}5)x10^{-6}$ mbar. The electron gun, with hairpin electron source produces non monohromated electron beam that is crossed perpendicularly by the molecular beam, obtained by stainless steel needle. The electron gun can be rotated around the needle in the angular range from about -40° to 120°. The best energy resolution is limited by termal spread of primary electrons to about 0.5 eV. The angular resolution is better than ±2° [9].

Present calculations of cross sections are based on a corrected form of the IAM (Independent Atom Method), known as the SCAR (Sreen Corrected Additivitty Rule) procedure, with an improved quasifree absorption model potential, which includes relativistic and many body effects, as well as inelastic processes [10,11]. The role of the SCAR corrections to the standard IAM procedure is reducing the values obtained from the standard additivity rule to account for geometrical overlapping of atomic cross sections.

Preliminary results of relative DCSs for elastic electron scattering from furan molecule at 50, 75 and 100 eV, in the angular range from 25°-110° are presented in Fig. 1. Measured relative DCSs (full circles) and theoretical calculations (full curve), are normalized one to each other and compared. The shape of the experimental DCSs is well reproduced by the SCAR theory. Small disagreements appear for the lower energies (50 eV and 75 eV) in the low angular range. This could be due both experimental influences (since electron beam spreads with decreasing the incident electron energy) and less reliable SCAR DCSS at small scatering angles and low energies [3]. Present results are compared with experimental points reported by Khakoo et al. at 50 eV [6]. The later DCS generally show similar behaviour in the range from 40°-110°, however, a disagreement with the present theory is noticable at small angles. Note that the previous DCS [6] below 15º is obtained by extrapolating the experimental curve according to the theory.

To conclude, the elastic scattering of electrons from furan has been investigated and the relative DCSs were preliminary reported for the incident electron energies of 50, 75 and 100 eV. Generally, a good agreement between the present experiment and calculations, as well as with previous experimental results [6] is obtained. Further work is under run to extend the incident energy region and to determine absolute cross sections.

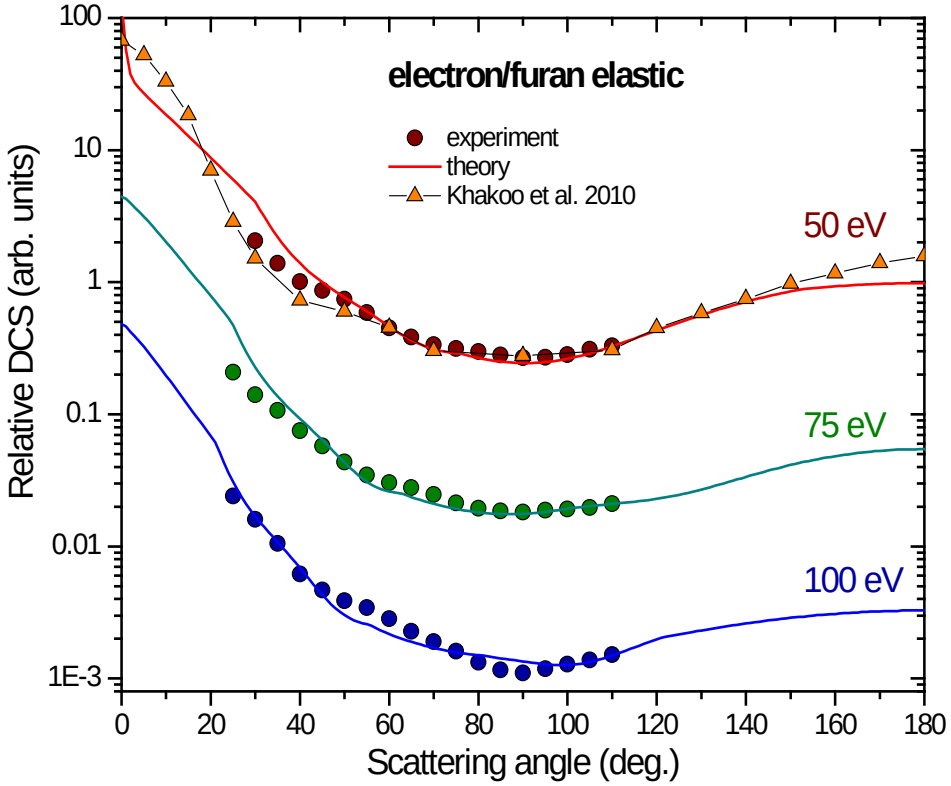

Fig. 1: Angular dependence of relative DCSs for elastic electron scattering from furan molecule. Full circles represent the experimental points, full lines represent the SCAR calculations and full triangles represent experimental points obtained by Khakoo et al. [6] .

The work was supported by the Ministry of Education and Science of Republic of Serbia (Project No.171020) and Spanish Ministerio de Ciencia e Innovación Project FIS2009-10245, and motivated by the COST Action MP1002 nano-IBCT.

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