BRATISLAVA

CEPAS 2014

6TH CONFERENCE ON ELEMENTARY PROCESSES IN ATOMIC SYSTEMS

Contributed Papers

9. - 12. JULY 2014

BRATISLAVA

CEPAS 2014

CONTRIBUTED PAPER

Editors
Štefan Matejčík Peter Papp Ondrej Bogár

Department of Experimental Physics, Comenius University
Bratislava, Slovakia

Bratislava, 2014

CONTRIBUTED PAPERS
of the
6th CONFERENCE ON ELEMENTARY PROCESSES IN ATOMIC SYSTEMS

9th - 12th July 2014,
Bratislava, Slovakia

Editors
Štefan Matejčík Peter Papp Ondrej Bogár

Publisher
Comenius University
Faculty of mathematics physics and informatics
Mlynská dolina
842 48 Bratislava, Slovakia

ISBN 978-80-8147-021-9

sponsored lecture

John Tanis

TRANSMISSION OF ELECTRONS THROUGH MICOMETER GLASS CAPILLARIES AND DIFFERENCES WITH IONS

Conference Topics

1. photo-processes and laser collisions
2. electron(positron)/atom collisions
3. collisions with biomolecules
4. heavy particles (ion/atom) collisions
5. interactions with surfaces
6. processes with nanosized complex systems

Local Organizing Committee,
(Comenius University, Bratislava, Slovakia)

Štefan Matejčík (Chairman)
Peter Papp (Secretary)
Katarína Matejčíková
Ondrej Bogár
Michal Lacko
Anita Ribar

International Scientific Committee

Bratislav P. Marinković	Serbia
Károly Tőkesi	Hungary
Zoran Lj. Petrović	Serbia
Mariusz Zubek	Poland
Jiří Horáček	Czech Republic
Gustavo Garcia Gomez-Tejedor	Spain
Joachim Burgdorfer	Austria
John A. Tanis	USA
Friedrich Aumayr	Austria
Robert DuBois	USA
Andrey Solov'yov	Germany
Ladislau Nagy	Romania
Viorica Stancalie	Romania
Nigel J. Mason	United Kingdom
Otto B. Shpenik	Ukraine

EJECTED ELECTRON SPECTRA FROM AUTOIONIZATION REGION IN NEON AT INCIDENT ELECTRON ENERGY OF 505 EV AND EJECTION ANGLES OF 40° AND 130°

Bratislav P. Marinković, Jozo J. Jureta, Aleksandar R. Milosavljević

Laboratory for Atomic Collision Processes, Institute of Physics, University of Belgrade, Pregrevica 118, 11080 Belgrade, Serbia
E-mail: bratislav.marinkovic@ipb.ac.rs

In the present work we have studied autoionizing states and resonances in neon atom, in the energy region of ejected electrons from 21 to 30 eV (42.56 to 51.56 eV of excitation energy), at the constant incident electron energy of 505 eV and two ejection angles of 40^o and 130^o with respect to the incident beam direction. The measurements have been carried out on a high-resolution crossed electron-atom beam apparatus, allowing to resolve both singlet and triplet states. Furthermore, we found that the shape of spectral features close to the resonances strongly depend on the ejection angle.

1. Introduction

Autoionization states and resonances in neon have been studied in the past by electrons, photons and ions but with luck of theoretical calculations comparing to calculations in helium. Especially, the energy region from 43 to 51 eV of excitation energies has been studied by low energy electrons [1] as well as by high energy electron using energy-loss spectroscopy at zero scattering angle [2,3]. Also, the resonances in this energy region have been studied in the past using low energy electrons as projectiles [4]. Here we present measurements of autoionizing states and resonances in neon at constant incident electron energy of 505 eV and two ejection angles of 40^o and 130^o with respect to the incident beam direction in order to show the angular behavior of excited states.

2. Experimental Set-up

The measurements have been carried out on a crossed electron-atom beam apparatus OHRHA [5] which involves an electron gun that can be rotated around analyzer axis, electrostatic lenses, a hemispherical analyzer with 7 channeltrons as detectors and an interaction region with a gas needle as an atomic source. The energy resolution of the ejected electron spectra was measured as full width at half maximum (FWHM) of the narrowest feature in the spectrum and was typically between 60 and 80 meV.

3. Results

The results of measurements are shown in figure 1. We present the ejected electron spectra with subtracted background without any normalization of the obtained data measured at two different ejection angles of 40^o and 130^o. The high energy resolution is demonstrated in the separation between triplet and singlet states of 0.1 eV. The difference in form of the measured spectral features for the two ejection angles is clearly visible from the figure. Two series of triplet and singlet $2s2p^6ns,np$ excited states could be assigned. There are also several dominant resonances. The calibration point was taken from the mixture of helium and neon at 505 eV identifying the well known $(2s2p)^1P$ state in autoionization region of helium at 35.54 eV (60.13 eV of excitation energy) [6]. The autoionizing states have been assigned according to the reference [7]. The positions of resonances from literature [4] are shown at the bottom of the figure. Most of the resonances measured at low incident electron energy are not seen in our ejection spectra except two of them at 22 eV (R1), and 27.54 eV (R2) indicating that they belong to the class of non-valence resonances already seen in helium [8,9].

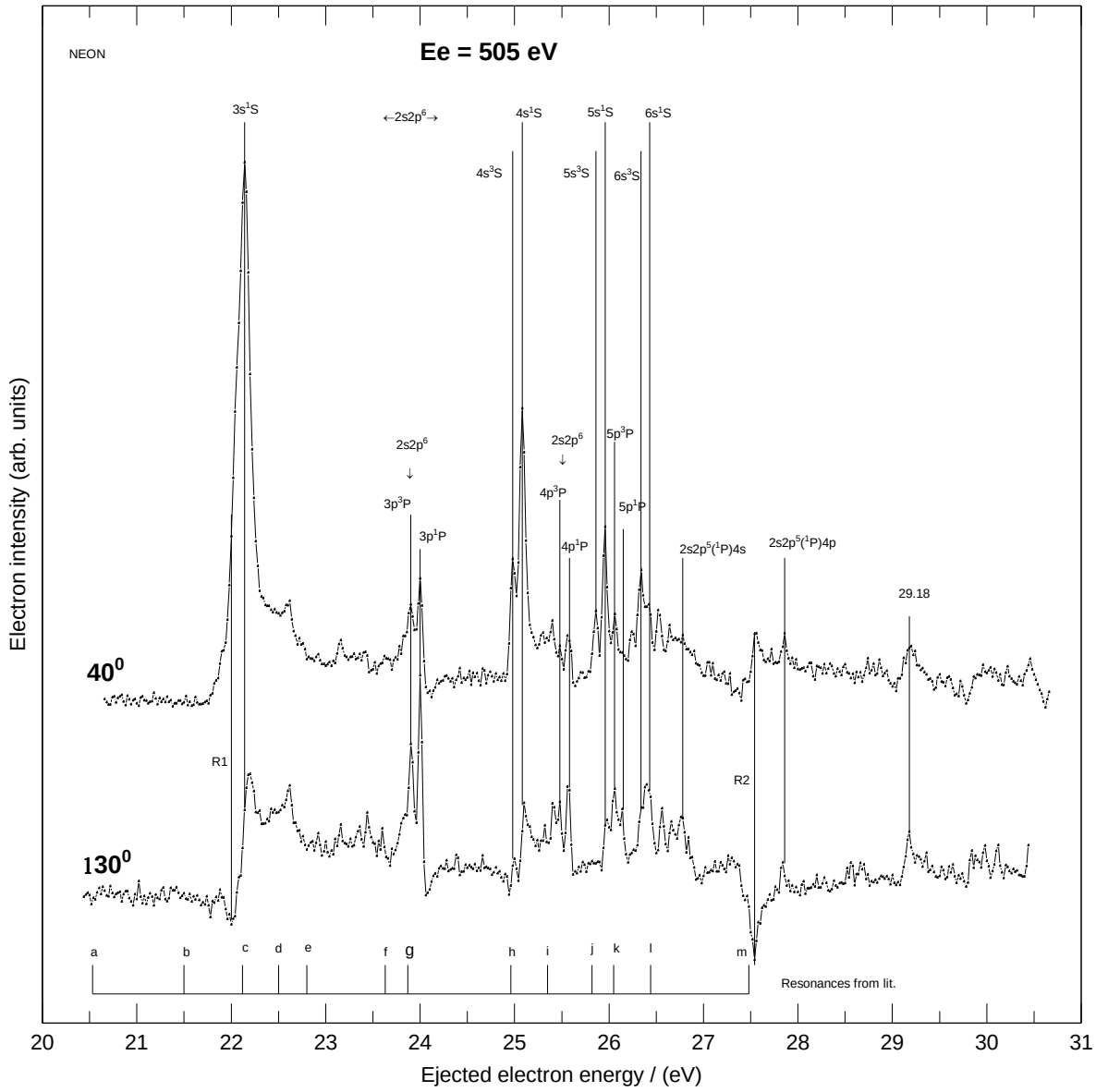

Fig. 1. Ejected electron spectra of autoionizing states of neon obtained at the excitation electron energy of 505 eV and the ejection angles of 40° and 130° labeled on the left hand side of the figure. The energy region of ejected electrons is from 20.5 to 30.5 eV or 42.06 to 52.06 eV of excitation energy with energy width per channel of 0.020 eV. Long vertical lines show energy positions of the features, while short vertical lines at the bottom of the figure mark positions of resonances from literature [4].

4. References

[1] Sharp J M, Comer J and Hicks P J, 1975 *J. Phys. B : Atom. Molec. Phys.* **8** 2512.
[2] Chan W F, Cooper G, Guo X and Brion C E 1992 *Phys. Rev. A* **45** 1420.
[3] Zhong Z P *et al* 1997 *Phys. Rev. A* **55** 3388.
[4] Buckman S J and Clark C W, 1994 *Rev. Mod. Phys*. **66** 539.
[5] Jureta J J, Milosavljević A R and Marinković B P 2014 *Int. J. Mass Spectrom.* DOI: 10.1016/j.ijms.2014.03.002
[6] Madden R P and Codling K 1963 *Phys. Rev. Lett.* **10** 516.
[7] Edwards A K and Rudd M E 1968 *Phys Rev* **170**, 140.
[8] Nesbet R K 1978 *J.Phys.B :At. Mol. Phys.* **11** L21.
[9] van der Burgt P J M and Heideman H G M 1985 *J. Phys. B :At. Mol. Phys.* **18** L755.