Stojan M. Madzunkov

28583 N Herrera st, 91354 Valencia, CA

Contact information:
Home Phone: (626)639-2802
Mobile Phone: (626)710-8927
Office Phone: (818)354-2480
E-Mail: Stojan.Madzunkov@jpl.nasa.gov

Education History:

PhD degree (Physics), Stockholm University, January 2004
MSc (Physics), Institute of physics, Belgrade, November 1998
BSc (Physics), Belgrade University, December 1995

Citizenship:

Citizen of Serbia, Visa Type H1.

Employment:

September 2004 to September 2006: Caltech Postdoctoral Scholar at the Jet Propulsion Laboratory/Caltech (Sec 3264)
September 2006 to present: Member of Science Staff at the Jet Propulsion Laboratory/Caltech, Atomic and Molecular Physics Group (Sec. 326).

Project:

1. Simulation of interstellar recombination on solid surfaces
This project involves the design, construction and testing of an apparatus capable of creating fast neutral O and H beams with well defined energy, energy width, quantum state, and flux. This apparatus is the only one of its kind in the world. It has been used to demonstrate for the first time that surface interactions of a fast, neutral $O(^3P)$ beam with abundant, frozen CO ice on a gold surface can produce a more complex molecule, CO_2, in interstellar dust clouds.

2. Measurement of negative ion dissociative electron impact cross sections.
Following a thorough mapping of the performance of the fast-atom source, a proposal has been submitted to JPL's Research and Technology Development Program to use the apparatus in a novel operational mode. After the necessary modifications were designed and implemented the apparatus was demonstrated to have much greater precision, resolution and detection sensitivity than instruments used previously. The apparatus will be used to study magnetic field effects (***B***-field induced potential-energy curve crossings) in dissociative electron attachment.

3. Working with Vehicle Cabin Air Monitor (VCAM) apparatus
The VCAM unit is designed for the international space station (ISS) to monitor the air quality as well as the mayor air constituent's abundances. I am integral part of the science team involved in preparing the VCAM for final delivery to ISS in March 2010.

June 2004 to September 2004: Stockholm University (Research Associate)

Project:

Data analysis

March 2004 to June 2004: Institute of Physics Belgrade (Research Associate)

Project:
Write software for the computer automation (electron and ion optics) of a scientific apparatus for the measurement of differential cross sections.

November 1999 – January 2004: PhD Studies in Stockholm University

Projects:
1. Design, construct, and operate an apparatus to study the collisions of highly charged ions and neutrals (He and Xe). Investigate the X-ray emission following multiple electron capture.
2. Design, and modification of apparatus to measure the Lamb shift in lithium-like krypton, and isotopic shifts in copper-like lead using dielectronic recombination resonances; primary person involved in measurements.
3. Measure gain profiles from laser (linearly polarized)-induced dielectronic recombination.

Jan 1995 to November 1998: Institute of Physics, Belgrade (MSc. Physics Student)

Project:
Investigate the energy and angular distribution of electron-impact dissociation fragments.
1. Design and construct the system electronics, predominantly highly-stable DC power supplies for the electron gun and double cylindrical mirror analyzer.
2. Design and test a low-energy (1 to 100 eV) electron gun with constant current and magnification independent of electron energy
3. Write software codes for the computer control of the apparatus.
4. Acquire data and analyze.

Physics Experience and Technical Skills

Theory, design, and operation of mass spectrometers (quadrupole, ion trap, and TOF)
Theory, design, modeling, and operation of electron and ion optics

Modeling of ion and electron trajectories in electron and ion scattering processes
Theoretical modeling of physical and chemical systems using Mathematica
Theory and operation of a temperature-programmed desorption apparatus, and modeling of observed TPD spectra as a function of surface binding energy and temperature
Design, construction, and operation of ultra high vacuum systems
Computer programming (VC++, Basic, C, FORTRAN).
Laser spectroscopy and high-energy laser operation.

Experience as a mentor/advisor

Have worked with, and advised, students through Master's Degree and PhD programs.

Recent Publications:

1 **New Improvements on the KSU-CRYEBIS, a User Facility for Low Energy, Highly Charged Ions**
M. P. Stockli, C. L. Cocke, A. Cuquemelle, B. D. DePaola, C. Doudna, Eastman, E. Edgu-Fry, T. Ehrenreich, C. Fehrenbach, D. Fry, P. E. Gibson, S. Kelly, U. Kentsch, N. Kobayashi, U. Lehnert, J.Matsumoto, S. Madzunkov, I. Reiser, P. Richard, R. Schedler, and T. N. Tipping
Review of Scientific Instruments **71**, 902 (2000)

2 **Unexpected X-Ray Emission due to Formation of Bound Doubly Excited States**
R. Schuch, S. Madzunkov, E. Lindroth and D. Fry
Phys. Rev. Lett. **85**, 5559 (2000)

3 **X-ray Emission by a Two-Electron Process in Electron Capture with Slow Highly Charged Ions**
R. Schuch, S. Madzunkov, E. Lindroth and D. Fry
Physica Scripta **T92**, 460 (2001)

4 **Dielectronic Recombination Resonances in Kr^{33+}**
S. Madzunkov, N. Eklöw, E. Lindroth, M. Tokman and R. Schuch
Physica Scripta **T92**, 357 (2001)

5 **QED Effects in Lithium-like Krypton**
S. Madzunkov, E. Lindroth, N. Eklöw, A. Paál and R. Schuch
Phys. Rev. A **65**, 032505 (2002)

6 **Dielectronic Recombination of Lithium-like Beryllium: A Theoretical and Experimental Investigation**
T. Mohamed, D. Nikolic, E. Lindroth, S. Madzunkov, M. Fogle, M. Tokman, and R. Schuch
Phys. Rev. A. **66**, 022719 (2002)

7 **High Resolution Studies of Electron–Ion Recombination**
R. Schuch, M. Fogle, P. Glans, E. Lindroth, S. Madzunkov, T. Mohamed

and D. Nikolic,
Radiation Physics and Chemistry **68,** 51 (2003)

8 **Dielectronic Recombination Used As a Tool for Spectroscopic Studies of Highly Charged Ions**
P. Glans, M. Fogle, S. Madzunkov2, M. Tokman, D. Nikolic, T. Mohamed N. Eklöw, N. R. Badnell, E. Lindroth and R. Schuch
Physica Scripta. **T110,** 212–215, (2004)

9 **Multiple Electron Capture and Photon Emission of Slow Highly Charged Ta^{q+} Ions in Collisions with He and Xe**
S. Madzunkov, D. Fry and R. Schuch
J. Phys. B. **37**, 3239 (2004)

10 **Dielectronic Resonance Method for Measuring Isotope Shifts**
R. Schuch, E. Lindroth, S. Madzunkov, M. Fogle, T. Mohamed, and P. Indelicato
Phys. Rev. Lett. **95**, 183003 (2005)

11 **Electron-ion recombination of Be-like C, N, and O**
M Fogle, N R Badnell, P Glans, S D Loch, S Madzunkov, M S Pindzola, and R Schuch
*Astronomy and Astrophysics **442**, 757 (2005).*

12 **Experimental Determination of Differential Cross Section Surface for Elastic Electron-atom (molecule) Scattering**
A R Milosavljevic, S Madzunkov, D Sevic, I Cadez and B Marinkovic
J. Phys. B: At. Mol. Opt. Phys. **39**, 609 (2006*)*

13 **Characteristic X Rays from Multiple Electron Capture by Slow Highly Charged Ions from He and Xe Atoms**
S. Madzunkov, D. Fry, E. Lindroth and R. Schuch
Phys. Rev. A **73**, 032715 (2006)

14 **First Measurement of Polyatomic Molecule Formation on an Icy Grain Analogue Using Fast Atoms**
S. Madzunkov, B. Shortt, J. MacAskill, M. Darrach and A. Chutjian
Phys. Rev. A **73**, 020901(R) (2006).

15 **Different isotope and chemical patterns of pyrite oxidation related to lag and exponential growth phases of acidithiobacillus ferrooxidans reveal a microbial growth strategy**
Brunner B, Yu JY, Mielke RE, MacAskill JA, Madzunkov S, McGenity TJ, Coleman M
Earth and Planetary Science Letters,. **270**, 63, (2008)

16 **Digitally synthesized high purity, high-voltage radio frequency drive electronics for mass spectrometry**
R. T. Schaefer, J. A. MacAskill, M. Mojarradi, A. Chutjian, M. R. Darrach, S. Madzunkov and B. J. Shortt
Review of Scientific Instruments, **79**, 095107 (2008).

17 **Formation of the Formaldehyde and Carbon Dioxide on an Icy Grain Analogue using Fast Hydrogen Atoms**
S. Madzunkov et al
Astrophysical Journal **697**, 801 (2009).

18 **Formation of Carbon Dioxide, Methanol, Ethanol and Formic Acid on an Icy Grain Analog using Fast Oxygen Atoms**
S. M. Madzunkov, J. A. MacAskill, and A. Chutjian
Astrophysical Journal **712**, 194 (2010)

19 **Formation of CO_2 H_2CO, CH_3OH, HCOOH, and CH_3CH_2OH on an Icy Grain Analog Using Superthermal H and O Atoms**
S. M. Madzunkov, J. A. MacAskill, M. R. Darrach, A. Chutjian, P. Ehrenfreund and G. Vidali
"Reionization to Exoplanets" will be published in a bound hard-cover book by Astronomical Society of the Pacific Conference Series (ASPCS). (http://www.aspbooks.org)

20 **Results from the Vehicle Cabin Atmosphere Monitor: A Miniature Gas Chromatograph/Mass Spectrometer for Trace Contamination Monitoring on the ISS and Orion**
A. Chutjian, M. R. Darrach, B. J. Bornstein, A. P. Croonquist, E. Edgu-Fry, D. J. Fry, V. Garkanian, M. A. Girard, V. R. Haemmerle, W. M. Heinrichs, R. D. Kidd, S. Lee, J. A. MacAskill, S. M. Madzunkov, L. Mandrake, T.M. Rust, R. T. Schaefer, J. L. Thomas, N. Toomarian, and M. J. Walch
ICES, September 2008, Prague, Czech Republic

21 **Validation Test Results from the Vehicle Cabin Atmosphere Monitor**
M. R. Darrach, A. Chutjian, B. J. Bornstein, A. P. Croonquist, V. Garkanian, V. R. Haemmerle, W. M. Heinrichs, D. Karmon, J. Kenny, R. D. Kidd, S. Lee, J. A. MacAskill, S. M. Madzunkov, L. Mandrake, T.M. Rust, R. T. Schaefer, J. L. Thomas, and N. Toomarian
ICES, September 2010, Nantes, France

Selected Contributions:

Evidence of Core Excitation in Highly Charged Ion-Atom Collisions
S. Madzunkov, J. Anton, D. Fry, E. Lindroth, R. Schuch
20th SPIG, ZLATIBOR, Yugoslavia, September, 2000

Measurement of the hyperfine shift in Cu-like lead 207 by dielectronic recombination
M. Bjorkhage, H. danared, M. Fogle, P. Indelicato, E. Lindroth, S. Madzunkov, T. Mohamed and R. Schuch
XXVI Int. Conf. Photonic, Electronic, Atomic Collisions (Stockholm, Sweden (07/03)

Spectroscopy of QED effects in lithium-like krypton
S. Madzunkov, N. Eklöw, M. Fogle, T. Mohamed, E. Lindroth and R. Schuch
XXVI Int. Conf. Photonic, Electronic, Atomic Collisions (Stockholm, Sweden (07/03)

Electron-ion recombuination rate coefficients for N^{2+}
P. Glans, N. Eklöw, M. Fogle, S. Madzunkov, T. Mohamed, R. Schuch and N. R. Badnell
XXVI Int. Conf. Photonic, Electronic, Atomic Collisions (Stockholm, Sweden (07/03)

Investigation of X-ray emission from doubole electron capture in collisions of slow highly charged ions and neutral atoms
S. Madzunkov, E. Lindroth, D. Fry and R. Schuch
XXVI Int. Conf. Photonic, Electronic, Atomic Collisions (Stockholm, Sweden (07/03)

Multiuple-electron transfer in close collisions of slow highly charged ions with atoms
M. Hoshino, T. Kambara, Y. Kanai, S. Madzunkov, R. Schuch and Y. Yamazaki
XXVI Int. Conf. Photonic, Electronic, Atomic Collisions (Stockholm, Sweden (07/03)

Measuring the hyperfine shift in Cu-like 207Pb by electron scattering resonances
R. Schuch, S. Madzunkov, M. Fogle, E. Lindroth, T. Mohamed and P. Indelicato
XXIV Int. Conf. Photon. Electron. Atom. Collisions (Rosario, Argentina, 20-26 July 2005)

Measurement of Reactions Using Fast Atoms: O(3P) (10 eV) + CO → CO2
S. Madzunkov, B. Shortt, J. MacAskill, A. Chutjian, and M. Darrach
XXIV Int. Conf. Photon. Electron. Atom. Collisions (Rosario, Argentina, 20-26 July 2005); and 2006 NASA Laboratory Astrophysics Workshop (U. Las Vegas, 2/06)

Novel Approaches to Stable Isotope Instruments for in situ Measurements of Mineral Samples
M. Coleman, C. Webster, A Chutjian, B Brunner, L Christensen, J MacAskill, S. Madzunkov, R Mielke and K Truong
European Geophysical Union General Assembly (Vienna, Abstracts 9, 05093, 2007)

Formation of Molecular Species on Grains Using Superthermal Atoms: The Reaction 2H (2 eV) + CO(s) → H_2CO(s)
S. Madzunkov, J. A. MacAskill, M. R. Darrach, G. Vidali, B. J. Shortt, and A. Chutjian
XXVth Int. Conf. Photon. Electron. Atom. Collisions (Freiburg, Germany, 7/07)

Formation of H_2CO and CO_2 on an Icy Grain Analogue Using Fast H-Atoms
S. Madzunkov, J. MacAskill, A. Chutjian, P. Ehrenfreund, M. Darrach, G. Vidali, B. Shortt
XXVI Int. Conf. Photonic, Electronic, Atomic Collisions (Kalamazoo, MI 7/09)

From Molecular to Highly-Charged Ions: Expansion of Laboratory Astrophysics Through Use of the Electrostatic Storage Ring with Electron Beam Ion Trap and Electrospray Ion Sources
A. Chutjian, N. G. Adams, J. A. MacAskill, S. M. Madzunkov, B. V. McKoy, R. Schuch, J. Simcic
White Paper on Laboratory Astrophysics, submitted to the National Academies of Sciences (3/09)

Formation of CO_2, H_2CO, CH_3OH, HCOOH, and CH_3CH_2OH on an Icy Grain Analog Using Superthermal H and O Atoms
A. Chutjian, S. M. Madzunkov, J. A. MacAskill, M. R. Darrach, P. Ehrenfreund, G. Vidali
214th AAS Meeting, Pasadena, CA (7/09)

Formation of CO_2, HCOOH, CH_3OH, and CH_3CH_2OH on an Icy Grain Analogue Using Fast O-atoms," A. Chutjian, S. M. Madzunkov, and J. A. MacAskill
Reionization to Exoplanets: Spitzer's Growing Legacy, Spitzer Science Center Conference, Pasadena, CA (10/09)

Formation of CO_2, CH_3OH and CH_3CH_2OH on an icy grain analogue using fast O-atoms
S. M. Madzunkov, J. A. MacAskill and A. Chutjian
XXVI Int. Conf. Photonic, Electronic, Atomic Collisions (Kalamazoo, MI 7/09)

Formation of H_2CO and CO_2 on an icy grain analogue using fast H-atoms
S. Madzunkov, J. MacAskill, A. Chutjian, P. Ehrenfreund, M. Darrach, G. Vidali and B. Short
XXVI Int. Conf. Photonic, Electronic, Atomic Collisions (Kalamazoo, MI 7/09)

Invited talks:

Energy and Angular Distributions of Positive Ions from Dissociative Ionization Processe
M. Kurepa, S. Madzunkov and I. Cadez
*Balkan Phys.Letters **5** (1998) 14-20*

Electron -Ion Recombination at Very Low Energy
R. Schuch, N. Badnell, N. Eklow, P. Glans, E. Lindroth, S. Mandzunkov, M. Tokman
20th SPIG, ZLATIBOR, Yugoslavia, September, 2000

Evidence of Core Excitation in Highly Charged Ion-Atom Collisions
S. Madzunkov, R. Schuch, D. Fry, E. Edgu-Fry, E. Lindroth, M. Tokman, J. Anton
Spectroscopy and Collision Dynamics with Highly Charged Ions, Abisko Scientific Research Station, Abisko, Sweden (2000)

Recombination of Highly-charged Ions with Cold Electrons: Plasma applications and Fundamental Spectroscopy
R. Schuch, M. Fogle, P.Glans, N. Eklow, E.Lindroth, S. Madzunkov, T. Ali Mohamed
XIIIth Symposium on Atomic, Cluster and Surface Physics (SASP 2002), February 2002 in Going/Kitzbühel, Tirol, Austria

The Atomic and Molecular Universe: Collisions in Hot Plasma to the Building Blocks of Life
A. Chutjian, J. A. MacAskill, S. M. Madzunkov, and J. Simcic
41st DAMOP, Houston, TX (5/10) (Invited Talk).

Using the Paul Ion Trap for Trace Species Detection in Space flight
S. Madzunkov, J. MacAskill, M. Darrach and A.Chutjian
21st International Conference on the Application of Accelerators in Research and Industry

Review Articles:

Resonances in ionization and recombination – a tool for spectroscopy
Eva Lindroth
37 EGAS conference, Dublin, August, 2005

Atomic physics with ions stored in the round
Reinhold Schuch and Sebastian Böhm
Journal of Physics: Conference Series 88 (2007) 012002

Rewards:

Performing Major Constituents Analysis (MCA) on the VCAM instrument including automated mass calibration using global optimization
NTR 46956, NASA, March 2009

Histogrammatic Method for Determining Relative Abundance (MCA) of Input Gas Pulse in the Presence of Obscuring Gas Background
NTR 47217, NASA, July 2009

The Mariner Award
July 2009

NASA Tech Brief Award
April 6, 2010

NASA Board Award
May 14, 2010

Patents:

Electronic drive and acquisition system for mass spectrometry
The present invention discloses an mixed signal RF drive electronics board that offers small, low power, reliable, and customizable method for driving and generating mass spectra from a mass spectrometer, and for control of other functions such as electron ionizer, ion focusing, single-ion detection, multi-channel data accumulation and, if desired, front-end interfaces such as pumps, valves, heaters, and columns.
International Application No.: PCT/US2007/010963

Histogrammatic Method for Determining Relative Abundance (MCA) of Input Gas Pulse in the Presence of Obscuring Gas Background
Lukas Mandrake; Ben J. Bornstein; Stojan M. Madzunkov; John A. MacAskill
Provisional Patent Application 61/240,559