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# Resume

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## ***Education:***

***Ph.D., Physics:*** March 1988; University of California, Riverside, California, U.S.A.

## ***Research Interests:***

- **Laboratory Spectroscopy**: UV emission, laser spectroscopy, mass spectroscopy, ionization techniques) relevant to planetary atmospheres and astrophysical plasmas
- ***In situ* Instrumentation/Detection Techniques:** Miniature mass spectrometers and ion mobility spectrometry, differential Mobility spectrometry, sample extraction, sample handling techniques and detection

## ***Professional Appointments:***

- ***Senior Research Scientist:*** July 2006-present; Jet Propulsion Laboratory.
- ***Section Manager:*** October 2004-May 2009; Planetary and Life Detection Section (supervised over 120 Ph. D. Scientists); Jet Propulsion Laboratory.
- ***Principal Scientist:*** 2002-present; Jet Propulsion Laboratory.
- ***Lead Scientist:*** 2001-2004; Instrument Development and Spectroscopy Research Element; Jet Propulsion Laboratory.
- ***Research Scientist and Team Leader:*** 1995-2001; Atomic and Molecular Collision Research Element, Spectroscopy and Detector Development Laboratory; Jet Propulsion Laboratory, Caltech, Pasadena, CA, USA.
- ***Adjunct Professor of Physics:*** 1996-2000; California State University, Fullerton.
- ***Scientist:*** 1992-1995; Jet Propulsion Laboratory, Caltech, Pasadena, CA, USA.
- ***National Academy of Sciences/National Research Council Research Associate:*** 1990-1992; JPL/Caltech, Pasadena, CA, USA.
- ***Postdoctoral Research Associate:*** 1988-1989; University of California, Riverside, USA.

## ***Other Professional Activities:***

***-Advisor*** for the National Academy of Sciences' National Research Council Resident Research Associateship Program (1992-present)
***-Chair, JPL Senior Research Scientist Council:*** 2007-2009
***-Chair:*** Division 32 Promotion Advisory Board (2002)
***-Strategic Initiative Lead-*** *Next Generation Mars and Planetary Sciences ($1,56M/year)*
***-Referee*** for the following scientific journals:
Journal of Physics B; Physical Review A; Physical Review Letters; Atomic Data and Nuclear Data Tables; Journal of Geophysical Research-Planets; Physics and Chemistry of Earth (C); Chemical Physics; Chemical Physics Letters; International Journal of Mass Spectrometry and Ion Processes
***-Member*** of the NASA Planetary Atmospheres and Astrophysics Programs Review Panels (1999-2014).

***-Ph.D. Co-Advisor to:***
- Dr. Hugh Kim, Department of Chemistry, California Institute of Technology, Pasadena, CA (2005-2010).
- Dr. Lauren White, Department of Chemistry and Biochemistry, UC Santa Barbara (2011-2014)

***- External Examiner*** of Dr. Paul Johnson's Ph. D. Dissertation Committee, University of Manitoba, Winnipeg, CANADA 1999).

***- Proposal Reviewer*** for the following Programs:
*NASA Planetary Atmospheres Program Office, NASA Astrophysics, NASA Origins, NASA Sample Return Laboratory Instruments and Data Analysis, NASA Planetary Instrument Definition and Development Program Office, NASA Space Physics Program Offices*

***Awards and Recognitions:***

- JPL *Explorer Award* for Strategic Road Map and implementation for Planetary Science
- Elected *Fellow of The Institute of Physics* (2001).
- NASA *Certificate of Recognition* (2004) for a new technique called "Miniature Focusing Time-of-Flight Spectrometer".
- NASA *Certificate of Recognition* (2001) for a new technique called "Proton-Transfer-Reaction-Ion-Mobility Spectrometry" (2001).
- Guest Editor for *Physics and Chemistry of Earth*, Published by the European Geophysical Society (2000).
- JPL Exceptional Technical Excellence Award (Individual) (1999).
- American Men and Women of Science (1997-98) edition.
- International Who's Who (American Biographical Institute, 1998 edition).
- JPL Technology and Applications Programs Group Achievement Award (1997).
- National Research Council, Resident Research Fellowship Award (1990-92).
- Dean's List for Outstanding Student (1985-1988); Univ. of California, Riverside.
- Republic of Turkey, Ministry of Education Fellowship Award for Ph. D. Degree (1982).

***Post Doctoral Advisor to:***

- Dr. Mihir B. Das (SAHA Nuclear Institute, India) - NRC Postdoctoral Fellow
- Dr. Craig Noren (University of Windsor, Canada) - Caltech Postdoctoral Fellow
- Dr. Victor Karaganov (Flinders University, Australia) - Caltech Postdoctoral Fellow
- Dr. Luther Beegle (University of Alabama, Birmingham, USA) - Caltech Postdoctoral Fellow
- Dr. Paul Johnson (University of Manitoba, Canada) - NRC Postdoctoral Fellow
- Dr. Charles Terrell (University of Virginia, USA) - NRC Postdoctoral Fellow
- Dr. Danut Dragoi (University of Denver, USA) - Caltech Postdoctoral Fellow
- Dr. Charles Malone (University of Windsor, CANADA) - NRC Postdoctoral Fellow
- Dr. Grazyna Orzechowska (UCLA, USA) - Caltech Postdoctoral Fellow
- Dr. De-Ling Liu (UCLA, USA) – Caltech Postdoctoral Fellow
- Dr. Timothy Glotch (Univ. of Arizona, USA) - Caltech Postdoctoral Fellow
- Dr. Ralph Milliken (Brown University, USA) - Caltech Postdoctoral Fellow
- Dr. Abigail Allwood (Macquarie University, Sydney, Australia) – NPP Fellow
- Dr. Robert Hodyss (Caltech, USA) - Caltech Postdoctoral Fellow
- Dr. Laurie Barge (USC, USA) - Caltech Postdoctoral Fellow
- Dr. Laurie Barge (USC, USA) – NPP Postdoctoral Fellow
- Dr. Marlen Menlyadiev (New Mexico State Univ., - Caltech Postdoctoral fellow)

***NASA Postdoctoral Program (NPP) Senior Faculty Advisor to:***

- Prof. William McConkey (University of Windsor, CANADA)
- Prof. Michael Russell (University of Glaskow, United Kingdom)
- Dr. Christopher Parkinson (University of Michigan, USA)

***NASA/ASEE Summer Faculty Advisor to:***

Prof. Murtadha. A. Khakoo (California State University, Fullerton)

***Distinguished Visiting Scientist Host/Sponsor for:***

Prof. Donald E. Shemansky (University of Southern California)
Prof. Christophe Sotin (University of Nantes, France)
Prof. Pascale Ehrenfreund (Leiden university, The Netherlands)
Prof. Jack Mustard (Brown University, USA)
Prof. Michael Russell (University of Glaskow, UK).

***External Funding as Principal Investigator (Last 5 years)* (*Total of ~$ 21 Million)***

**Principal Investigator – NASA-Astrobiology Institute CAN 7 (2015-2020);** Title: ICY WORLDS: Astrobiology at the Rock-Water Interface and Beyond **Amount: $8,083,000.**

**Principal Investigator – NASA-Astrobiology Institute CAN 5 (2009-2014);** Title: Astrobiology of Icy Worlds. **Amount: $7,100,000.**

**Principal Investigator** - **NASA PIDDP (2008-2011);** Title: Mars in-situ Chemical Analyzer . **Amount: $900,000**

**Principal Investigator** - **NASA Astrobiology: Exobiology and Evolutionary Biology Program (2008-2010);** Title: Origin and Evolution of Life and Clues from Hydrothermal Vent Deposits . **Amount: $298,000.**

**Principal Investigator** - **NASA Astrobiology Science and Technology Exploration Program (ASTEP) (2007-2010);** Title: Wet Chemistry on Mars: *WetChem* . **Amount: $2,720,000.**

**Principal Investigator** - **NASA Mars Fundamental Research (2015-2018);** Title: *Cross Section Measurements Important to Martian Atmosphere*. **Amount: $460,000.**

**Principal Investigator** - **NASA Planetary Atmospheres Program (PATM) (2012-2016);** Title: *Electron Impact cross Sections for Models of Ultraviolet Observations planetary atmospheres by Cassini and hubble Space telescope"* **Amount: $650K.**

**Principal Investigator** - **NASA Outer Planets Program (OPR) (2012-2016);** Title: *Electron Impact Excitation Cross Sections Relevant To Outer Planets Modeling"* **Amount: $600K.**

# PUBLICATIONS

## REFEREED ARCHIVAL JOURNAL PUBLICATIONS

**1.** Nickel J. C., Mott C., **Kanik I.**, McCollum D.C., "Absolute elastic differential electron scattering cross sections for carbon monoxide and molecular nitrogen in the intermediate energy region" *J. Phys. B: At. Mol. Phys.* **21***,* 1867 (1988).

**2. Kanik I.**, McCollum D.C., Nickel J.C., "Absolute elastic differential scattering cross sections for electron impact on carbon dioxide in the intermediate energy region" *J. Phys. B: At. Mol. Phys.* **22,** 1225 (1989).

**3. Kanik I.** " A method for obtaining the absolute differential cross sections in molecular electronic state excitations" *Turk. Fiz. Astrofiz.,* **14***,* No. 4, 348 (1990).

**4.** James G.K., Ajello J.M., **Kanik I.**, and Franklin B.O., and Shemansky D.E.," The extreme ultraviolet emission spectrum of CO produced by electron impact at 200eV" *J. Phys. B: At. Mol. Phys.,* **25***,* 1481 (1992).

**5. Kanik I.**, Nickel J.C., Trajmar S., "Total electron scattering cross section measurements for Kr, $O_2$, and CO" *J. Phys. B: At. Mol. Phys.* **25,** 2189 (1992).

**6. Kanik I.**, Trajmar S. and J.C. Nickel "Total electron scattering cross section measurements on $CH_4$ from 4 to 300 eV" *Chem. Phys. Lett.*, **193,** 281 (1992).

**7.** Nickel J.C., **Kanik I.**, Trajmar S., and Imre K. " Total electron scattering cross section measurements on $H_2$ and $N_2$ from 4 to 300 eV" *J. Phys. B: At. Mol. Phys.*, **25**, 2427 (1992).

**8.** Ajello J.M., James G.K., **Kanik I.**, and Franklin B.O. " The complete UV spectrum of $SO_2$ by electron impact : Part 1, The vacuum ultraviolet spectrum" *J. Geophys. Res.,* **197**, No. A7, 10,473 (1992).

**9.** Ajello J.M., James G.K., and **Kanik I.**, "The complete UV spectrum of $SO_2$ by electron impact : Part 2, The middle ultraviolet spectrum" *J. Geophys. Res.,* **197**, No. A7, 10,501 (1992).

**10.** Ajello, J. M., **Kanik I.**, James, G. K. and Shemansky, D. E., "Electron impact emission cross sections needed in modeling UV observations of the upper atmospheres of the planets" *SPIE Proceedings*, **1764**,142 (1993).

**11. Kanik I.**, Trajmar S., and Nickel J. C. "Total electron scattering and electronic state excitation cross sections for $O_2$, CO, and $CH_4$." *J. Geophys. Res.,* **98**, 7447, (1993).

**12. Kanik I.**, Ajello J.M., James G.K., Franklin B.O., "Vacuum ultraviolet emission spectrum of $CO_2$ induced by electron impact at 200eV" *Chem. Phys. Lett.* **211**, 523, (1993).

**13. Kanik, I.**, Ratliff, M.and Trajmar, S.," Electron-Impact Excitation of the $B^1\Sigma$, $C^1\Sigma$ and $E^1\Pi$ States of CO at 100 eV", *Chem. Phys. Lett.* **208**, 341, (1993).

**14.** Clarke, J. T., Ajello, J. M., Luhmann, J. and **Kanik I.** "Hubble Space Telescope UV Spectral Observations of Io Passing into Eclipse", *J. Geophys. Res.-Planets,* **99**, 8387 (1994).

**15. Kanik, I.**, James, G. K. and Ajello, J. M. "Medium-Resolution Studies of Extreme-Ultraviolet Emission From CO by Electron Impact", *Phys. Rev. A*, **51**, 2067 (1995).

**16.** Shemansky, D. E., **Kanik, I.** and Ajello, J. M. "Fine-Structure Branching in $c_4'$ $^1\Sigma^+_u(0)$", *Ap. J.,* **452**, 480 (1995).

**17.** Shemansky, D. E., Ajello, J. M., and **Kanik, I.** "Electron Impact Studies of the Second Positive Band System of $N_2$", *Ap. J.,* **452**, 472 (1995).

**18.** Ajello, J. M., Ahmed, S., **Kanik, I.** and Multari, R. "Kinetic Energy Distribution of H(2p) Atoms From Dissociative Excitation of $H_2$", *Phys. Rev. Lett.*, **75**, 3261 (1995).

**19.** James, G. K., **Kanik, I.** and Ajello, J. M., "Far Ultraviolet Emission Cross Sections of Ne II and Ne III Excited by Electron Impact", *Ap. J.*, **445**, 769 (1995).

**20.** Ajello, J. M., **Kanik, I.** and Ahmed, S. "The Line Profile of Lyman-$\alpha$ From Dissociative Excitation of $H_2$ with Application to Jupiter", *J. Geophys. Res.*, **100**, 26, 411 (1995).

**21. Kanik, I.**, Ajello, J. M. and James, G. K., "Electron-Impact-Induced Emission Cross Sections of Ne in the Extreme Ultraviolet" *J. Phys. B*, **29**, 2355 (1996).

**22.** Ajello, J. M., Shemansky, D. E., **Kanik, I.**, James, G. K., Liu, X, Ahmed, S and Ciocca, M., "High Resolution UV Spectroscopy of $H_2$ and $N_2$ Applied to Observations of the Planets by Spacecraft" *J. Elect. Spect. & Rel.Phenomena*, **9**, 429 (1996).

**23.** M. A. Khakoo, M. A., Trajmar, S, LeClair, R. L, **Kanik, I.**, Csanak, G. and Fontes, C., "Differential Cross Sections for Electron Impact Excitation of Xe: I. Excitation of the Five Lowest Levels; Experiment and Theory" *J. Phys. B*, **29**, 3455 (1996).

**24.** M. A. Khakoo, M. A., Trajmar, S, Wang, S., **Kanik, I.**, Aguirre, A., and Fontes, C., Clark, R. E. H. and Abdallah, Jr., J., "Differential Cross Sections for Electron Impact Excitation of Xe; II. Excitation of the $6^{th}$ to $20^{th}$ Lowest Levels; Experiment and Theory" *J. Phys. B*, **29**, 3477 (1996).

**25. Kanik, I**. "Far Ultraviolet Emission Spectrum of Xe Induced by Electron Impact at 100 eV" *Chem Phys. Lett*, **258**, 455 (1996).

**26.** Ahmed, S. M., **Kanik, I.** and Link, R., "Temperature Dependent Photoabsorption Cross Section Measurements of $O_2$ at O I 1304-Å Triplet Emission Lines" *Chem. Phys. Lett.*, **259**, 545 (1996).

**27.** Trajmar, S. and **Kanik, I.**, "Electron Impact excitation of $C_{60}$ Adducts; Fluorescence from $C_{60}^+$OH and $C_{60}^+$H Species" *Chem. Phys. Lett.*, **262**, 241 (1996).

**28.** James, G. K., Slevin, J. A., Shemansky, D. E., Dziczek, D., Bray, I., **Kanik, I**. and Ajello, J. M. "The Excitation function of H Ly □□from Threshold to 1800 eV" *Phys. Rev. A*, **55**, 1069 (1997).

**29.** Ciocca, M., **Kanik, I.** and Ajello, J. M., "High Resolution Studies of Extreme-Ultraviolet Emission From CO by Electron Impact" *Phys. Rev. A*, **55**, 3547 (1997).

**30.** Zetner, P. W., Trajmar, S., Wang, S., **Kanik, I.**, Csanak, G., Clark, R. E. H., Abdallah, Jr., J. and Nickel, J. C., "Inelastic Electron Scattering by Laser-Excited $^{138}$Ba(...6s6p $^1P_1$) Atoms" *J. Phys. B*, **30**, 5317 (1997).

**31. Kanik, I.**, Beegle, L. W., Noren, C., Ahmed, S. M., and Link, R., "Temperature Dependent Photoabsorption Cross Section Measurements of $O_2$ at the N I Airglow and Auroral Emission Lines" *Chem. Phys. Lett*., **279**, 297 (1997).

**32.** Zetner, P. W., **Kanik, I.** and Trajmar, S., "Electron-Impact Excitation of $a^3\Pi$, a' $^3\Sigma^+$, d $^3\Delta$ and A $^1\Pi$ States of CO at 10.0, 12.5 and 15.0 eV Impact Energies", *J. Phys. B*, **31**, 2395 (1998).

**33.** Trajmar, S., **Kanik, I.**, Khakoo, M. A. LeClair L., Bray, I. Fursa, D. and Csanak, G., "Elastic Electron Scattering by Laser-Excited $^{138}$Ba (...6s6p $^1P_1$) Atoms *J. Phys. B.,* **31**, L393 (1998).

**34.**, Guo, X, Khakoo, M. A., Mathews, D. F., Mikaelian, G., **Kanik, I**., Trajmar, S., Zeman, V., Bartschat, K. and Fontes, C. J. "Differential Cross-Section Ratios for Low Energy Electron Impact Excitation of the $4p^5 5s$ Levels of Krypton- Sensitive Tests of Relativistic Effects for Heavy Noble Gases" *J. Phys. B*, **32** L155 (1999).

**35.** Trajmar, S., **Kanik, I.**, Khakoo, M. A. LeClair L., Bray, I. Fursa, D. and Csanak, G., "Elastic Electron Scattering by Laser-Excited $^{138}$Ba (...6s6p $^1P_1$) Atoms, *J. Phys. B,* **32**, (1999).

**36.** Khakoo, M. A., Paolini, B., Guo, X, Bray, I. Stelbovics, A., **Kanik, I.** and Trajmar, S., "Differential Cross Sections for the Electron Impact Excitation of the $1^2S \rightarrow 2^2S + 2^2P$ Levels of Atomic Hydrogen at 50 eV" *Phys. Rev. Lett.,* **82**, 3980 (1999).

**37.** Fursa, D. V., Trajmar, S. Bray, I. and **Kanik, I.**, Csanak, G., Clark, R. E. H., and Abdallah, Jr., J., "Integral Cross Section for Electron Scattering by Ground-State Ba Atoms", *Phys. Rev. A,* **60**, 4590 (1999).

**38.** Zetner, P.W., Trajmar, S., **Kanik, I.**, Wang, S. Csanak, G. Clark, R. E. H., Abdallah Jr., J., Fursa, D. and Bray, I. "Differential Cross sections for Electron Impact Excitation Out of the Metastable Levels of the Barium Atom", *J. Phys. B*, **32**, 5123 (1999).

**39.** Khakoo, M. A., Paolini, B., Guo, X, Bray, I. Stelbovics, A., **Kanik, I.**, Trajmar, S., and James, G. K. "Differential Cross Sections for the Electron Impact Excitation of the $1^2S \rightarrow 2^2S + 2^2P$ Levels of Atomic Hydrogen at 30, 40, 50, and 100 eV, *Phys. Rev. A,* **61**, 12701 (2000).

**40.** Guo. X, Mathews, D. F., Mikaelian, G, Khakoo, M. A., Crowe, A, **Kanik, I.**, Trajmar, S., Zeman, V. Bartschat, K. Fontes, C. J., "Differential Cross Sections for the Electron Impact Excitation of Krypton at Low Incident Energies I: Excitation of the $4p^5 5s$ Configuration" *J. Phys. B*, **33**, 1895 (2000).

**41.** Guo. X, Mathews, D. F., Mikaelian, G, Khakoo, M. A., Crowe, A, **Kanik, I.**, Trajmar, S., Zeman, V. Bartschat, K. Fontes, C. J., "Differential Cross Sections for the Electron Impact Excitation of Krypton at Low Incident Energies II: Excitation of the $4p^5 5p$, $4p^5 4d$, $4p^5 6s$ Configurations" *J. Phys. B*, **33**, 1921 (2000).

**42. Kanik,** I., Beegle, L. W., Ajello, J. M., and Solomon, S. C., "Excitation, Emission and Photoabsorption Cross Sections Important in the Terrestrial Airglow and Auroral analysis of Rocket and Satellite Observations", *Phys. and Chem. of Earth (C)*, **25**, 573 (2000).

**43.** Noren, C., **Kanik, I.,** Ajello, J. M., McCartney, P., McClintock, W. and Drake, V., "Emission Cross Sections of OI (130.4 nm) and OI (135.6 nm) at 100 eV Resulting from Electron Impact Dissociative Excitation of $O_2$", *Geophys. Res. Lett.*, **28**, No. 7, 1379 (2001).

**44. Kanik, I**., Johnson, P. V., and James, G. K. "Electron-Impact-Excitation and Electron-Impact Induced Emission Cross Sections of Xe at Low Energies", *J. Phys. B*, **34**, 1465 (2001).

**45.** Beegle, L. W., **Kanik, I.**, Markowski, L. and Hill Jr., H. H., "Electrospray-Ionization High-Resolution Ion Mobility Spectrometry for Detection of Organic Compounds I: Amino Acids" *Anal. Chem.,* 73, 3028 (2001).

**46. Kanik, I.,** Johnson, P. V., Das, M. B., Khakoo, M. A., and Tayal, S. S., "Electron Impact Studies on Atomic Oxygen. I: Differential and Integral Cross Sections; Experiment and Theory*" J. Phys. B*, **34**, 2647 (2001).

**47.** Noren, C., **Kanik, I**., McCartney, P., James, G. K. and Ajello, J. M., "Electron-Impact Studies on Atomic Oxygen. II: Emission Cross Section Measurements of the OI $^3S \rightarrow {}^3P$ Transition (130.4 nm)", *J. Phys. B*, **34**, 2667 (2001).

**48.** Johnson, P. V. and **Kanik, I.** "Electron-Impact-Induced Excitation Cross Sections of $O_2$ at 20, 30, 50 and 100 eV", *J. Phys. B*, 2001, **34**, 3041 (2001).

**49.** Fursa, D. V., Bray, I., Csanak, G., Clark, R.E.H., Abdallah Jr., J, **Kanik, I.** and Trajmar, S "Electron Impact Excitation of Excited Atomic Ba", *Phys. Rev. A*, **65**, 32723 (2002).

**50.** Matz, L. Hill, H. H., Beegle, L. W. and **Kanik, I.,** "Investigation of Drift Gas Selectivity in High Resolution Ion Mobility Spectrometry with Mass Spectrometry Detection" *J. Amer. Soc. Mass Spect.,* **13**, 300 (2002).

**51.** Khakoo, M. A., Wrkich, J., Larsen, M., Kleiban, G., **Kanik, I.,** Trajmar, S., Brunger, M. J., Teubner, P. J. O., Crowe, A., Fontes, C. J., Bartschat, K., and Madison, D. H., "Differential Cross Sections and Cross Section Ratios for Electron Impact Excitation of the Neon $2p^5 3s$ Configuration" *Phys. Rev. A*, **65**, 062711 (2002).

**52.** Wrkich, J. Mathews, D. **Kanik, I.,** Trajmar., S. and Khakoo, M. A. "Differential Cross-Sections for the Electron-Impact Excitation of Molecular Hydrogen"*J. Phys. B*, **35**, 4695 (2002).

**53.** Ajello, J. M, Hansen, D. L., Beegle, L. W., Terrell, C. A., **Kanik,** I., James, G. K., and O. P. Makarov "The Middle Ultraviolet and Visible Spectrum of $SO_2$ by Electron Impact". *J. Geophys. Res.,* **107**, 1099 (2002).

**54.** Beegle, L. W., **Kanik, I.**, Markowski, L. and Hill Jr., H. H., "Effects of Drift-Gas Polarizability on Glycine Peptides in Ion Mobility Spectrometry" *Int. J. of Mass Spect.,* **216**, 257 (2002).

**55.** Hartley, F. T. and **I. Kanik**, "A Nanoscale Soft-ionization Membrane: A Novel Ionizer for Ion Mobility Spectrometers for Space Applications" *SPIE Proceedings,* **4946**, 4936-64 (2003).

**56.** Johnson, P. V., **Kanik, I.**, Shemansky, D. E. and Xiaming, L., "Electron-Impact Emission Cross Section of Atomic Oxygen in the Ultraviolet Spectral Region" *J. Phys. B*, **36**, 3203 (2003).

**57.** Makarov, O., **Kanik, I.,** and Ajello, J. M. "Electron Impact Dissociative Excitation of $O_2$.I: Kinetic Energy Distributions of Fast Oxygen Atoms" *J. Geophys. Res.*, **108**, 11,029 (2003).

**58. Kanik, I.,** Noren, C., Makarov, O., and Ajello, J. M.,"Electron Impact Dissociative Excitation of $O_2$.II: Emission Cross Sections of OI (130.4 nm) and OI (135.6 nm)" *J. Geophys. Res.*, **108**, 11,040 (2003).

**59.** Khakoo, M. A., Vandeventer, P., Childers, J. G., **Kanik, I.,** Fontes, C. J., Bartschat, K., Zeman, V., Madison, D. H., Saxena, S., Srivastava, R. and Stauffer, A. D., "Electron-Impact Excitation of the Argon $3p^5 4s$ Configuration: Differential Cross Sections and and Cross Section Ratios" *J. Phys. B*, **37**, 247 (2004).

**60.** Johnson, P.V., Kim, H. I., Beegle, L. W., and **Kanik, I.,** "Electrospray Ionization Ion Mobility Spectrometry of Amino Acids: Ion Mobilities and a Mass-Mobility Correlation", *J. Chem. Phys*., **108**, 5785 (2004).

**61.** Makarov, O. P., Ajello, J. M., Vattipalle, P., **Kanik, I.,** Festou, M. C. and Bhardwaj, A. B., "Kinetic Energy Distributions and Line Profile of Dissociation Products of Water upon Electron Impact", *J. Geophys. Res.*, **109**, A09303 (2004).

**62. Kanik, I.** and Srivastava, S. K.,"Miniature Focusing Time-of-Flight Mass Spectrometer", *NASA Tech Briefs*, **29**, 23 (2005).

**63.** Liu, X, Shemansky, D. E., Marco Ciocca, M., and **Kanik, I.** and Ajello, J. M**,** "Analysis of Physical properties of the c$'\,^1\Sigma^{\square}_u$ (0)-X $^1\Sigma^{\square}_g$ (0) Transition", *Ap.J.* **623**, 579 (2005).

**64.** Kim, H. I, Johnson, P. V., Beegle, L. W. and **Kanik, I.,** "An Equilibrium Partitioning Model for Analyte Response in Electrospray Ionization as a Function of Electrolyte Concentration" (Submitted to Int. J. of Mass Spect., 2005).

**65.** Khakoo, M. A, Johnson, P. V., Ozkay, I., Yan, P. and **I. Kanik**, I., Low Energy Electron Impact Excitation of the A $^3E^+_u$, B $^3A_g$, W $^3)_u$, B′ $^3\Gamma^-_u$, a′ $^1\Gamma^-_u$, a$^1A_g$, w $^1)_u$ and C $^3A_g$ States of $N_2$, *Physical Review A: Atomic, Molecular, and Optical Physics*, 71 (6): No. 062703 (2005).

**66***.* Johnson P. V., Malone C. P., **Kanik I**, Tran K., Khakoo M. A. Integral cross sections for the direct excitation of the A (3)Sigma(+)(u), B (3)Pi(g), W (3)Delta(u), B ' (3)Sigma(-)(u), a ' 1 Sigma(-)(u), a (1)Pi(g), w (1)Delta(u), and C (3)Pi(u) electronic states in $N_2$ by electron impact, *J. Geophys. Res.– Space Phys*. 110 (A11) No. A11311, (2005).

**67**. H. I. Kim, P. V. Johnson, L. W. Beegle, J. L. Beauchamp, and **I. Kanik** and, Electrospray Ionization Ion Mobility Spectrometry of Carboxylic Anions: Ion Mobility and a Mass-Mobility Correlation, *Journal of Physical Chemistry,* A **109** (35), 7888 (2005).

**68.** Johnson, P. V., McConkey, J. W, Tayal, S. S. and **Kanik, I.,** "Collisions of Electrons with Atomic Oxygen: Current Status", Can. J. Phys., 83 (10), 1071 (2005).

**69.** Johnson, P., J. McConkey, S. Tayal and **I. Kanik** (2005) *Erratum: Collisions of electrons with atomic oxygen: current status* Canadian Journal of Physics **83**(10): 1071-1072.

**70**. Wang, S., Johnson, P. V., Charles P. Malone, C. P., and **Kanik, I.** "Transmission effects in unfolding electronic-vibrational electron-molecule energy-loss spectra", Phys. Rev. A, **73 (3):** Art. No.034702 (2006).

**71.** Goguen, J. D., Orzechowska, G., Johnson, P. V., Tsapin, A., **Kanik, I.,** and Smythe, W., Decomposition of Amino Acids in 100 K Ice by UV Photolysis: Implications for Survival on Europa Bulletin of the American Astronomical Society 38, 539 (2006).

**72.** Orzechowska, G. E., Goguen, J., Johnson, P. V.,Tsapin, A and **Kanik, I**. Photolysis of amino acids in a 100 K water ice matrix: Application to the outer Solar System bodies, Icarus, **187** (2): 584-591 (2007).

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