

Y. Azuma

Curriculum Vitae

Yoshiro Azuma

Visiting Professor of Physics (Until June, 2024)

Physics Department

Indian Institute of Technology Delhi

Hauz Khas, New Delhi - 110 016

Phone +81-90-3226-7406

Email: y-azuma@sophia.ac.jp

Personal:

Date of birth: December 5, 1954. Nationality: Japan, Marital status: Married.

Personal interests: Operatic singing, history, social anthropology, international studies, and special education.

Languages: Japanese, English

Education:

1980 B.S. Physics Gakushuin University

1982 M.S. Physics University of Oregon

1985 Ph.D. Physics University of Oregon (Supervised by Prof. J. T. Moseley.)

Thesis title: "High Resolution Spectroscopic Study of MgO and CuO"

Professional experience

1981 – 1985 Research Assistant, Dept. of Physics, Univ. of Oregon.

1985 – 1988 Postdoctoral Fellow, Chemistry Dept, University of British Columbia.

1988 – 1989 Postdoctoral Appointee, Physics Division, Argonne National Laboratory.

1989 – 1994 Assistant Scientist, Physics Division, Argonne National Laboratory.

1994 – 2008 Associate Professor, Institute of Materials Structure Science (IMSS, KEK)

1996 – 2008 Associate Professor, Graduate University for Advanced Studies

2008 - 2020 Professor, Department of Materials and Life Sciences, Sophia University

Since -2020— Visiting Professor, Sophia University

2021 -2024 Full-time Visiting Professor, Dept. of Physics Indian Institute of Technology Delhi.

2024 – Present- Full-time Visiting Professor, Dept. of Physics, BITS Pilani Goa Campus.

Academic societies: American Physical Society, Japanese Physical Society,

Japanese Synchrotron Radiation Research Society.

Committees

Physics Committee Member, National Center for Entrance Examinations of Japanese Universities (2001 - 2004).

Organization Committee Member: “International Conference on X-ray and Inner-Shell Processes” 1999-2005

Spring-8 Synchrotron: Proposal Evaluation Committee (AMO Physics), 2001- 2012.

Spring-8 Synchrotron: Beamline review committees in various capacities, 2001 - 2020.

Member of the Curriculum Committee, Entrance Examination Committee, and English Program Coordinator at the Graduate University for Advanced Studies. 2002-2008

Chairperson of the Graduate Program for Green Science and Engineering, at Sophia University. 2013 - 2016

Recipient of the “Lifetime Achievement Award”, CAMNP 2019, Delhi, India,

Organizer at IITD of the “Introduction to Sophia University” Event (2023), “Sophia Day” and “Indo-Japan Friendship Symposium”, “IITD-Sophia Workshop on Transportation Science and Technology”.(2024), India Day at Sophia University.

Areas of Interest

Atomic and Molecular Physics particularly photoionization studies of atoms and molecules. Synchrotron radiation science. Science education. International education. History of Science. Science in society.

Teaching Experience:

At Graduate University for Advanced Studies

Atomic and Molecular Physics (Graduate course)

Director: International Science School for Gifted High School Students (1996).

Atomic and Molecular Physics (Graduate course)

At Sophia University

General Physics (Undergraduate course)

Atomic and Molecular Physics (UG)

English for Scientists and Engineers (UG)

Environmental Atomic and Molecular Physics (MS)

Various short topical courses on modern physics as well as science and society/history at the undergrad and graduate level.

At Indian University of Technology Delhi

Electrodynamics (UG)

Atomic and Molecular Physics (M.Sc.)

Accelerator Based Atomic and Molecular Physics (UG)

Topics in theoretical physics. (UG)

Undergraduate seminar course. (UG)

B.Tech. Physics Laboratory

M.Sc. Physics Laboratory

Research Grants

JSPS-NSF Japan-US Collaboration 1995 - 1998

Matsuo Foundation Grant for Academic Research 1998

JSPS Post Doctoral Fellow Grant-in-Aid (Wehlitz, Sternberg, Sullivan, Harries, Lebech)

Ministry of Education Grant-in Aid for Private University Facility Developments 2010 - 2015

JSPS Grants for Basic Scientific Research, 2002 – 2006, 2010 – 2014, 2015 – 2020

Supervision of Post Doctoral Appointees:

Ming-Tie Huang (KEK-COE) 1997~1999, Currently at Saginaw Valley State Univ.

Ralf Wehlitz (JSPS) 1997~1999, Currently at the University of Wisconsin.

James Sternberg (JSPS) 1999~2001 Currently at the University of Tennessee.

Tadayuki Suzuki (KEK-COE) 2001~2003 Currently at Keio University.

James Sullivan (JSPS) 2001~2003 Currently at Australian National University.

James Harries (JSPS / KEK-COE) 2000~2005 Currently at Spring8.

Mogens Lebech (JSPS) 2005~2007

Satoshi Kosugi (Sophia PD Appointee) 2016-2020 Currently at Gakugeidai Univ.

Visiting collaborative scientists hosted:

Ivan Sellin (Univ. of Tennessee) JSPS, NSF Numerous times between 1994–1999.

Teijo Aberg (Helsinki University of Technology) KEK-COE Summer, 1996.

Anatoli Kheifets (Australian National Univ.) JSPS, Summers of 2000, 2002 and 2005.

James Sullivan (Australian National Univ.) Sophia Univ. Visiting Prof. 2010-2011

Ghanshyam Purohit (Sir Padampat Singhanian Univ) Sophia Univ. Visiting Prof. 2011

Emma Sokell (University College, Dublin) Sophia Univ. Visiting Prof. 2012

John Quinn (University College, Dublin) Sophia Univ. Visiting Prof. 2012

Tapan Nandi (IUAC Delhi) Sophia Univ. Visiting Prof. 2012-2013

Public relations:

Organizing Chair of the KEK Classical Concert Series 2000 - 2008.

Organizing host of the international discussion forum “Creating a fulfilling life in Japan” at Sophia University, 2016 –2020.

Volunteer Teacher of Japanese at the Blind Relief Association of Delhi, the only Japanese language class in India for the visually impaired. Delhi 2023—

Summary of research career:

A. High Resolution Laser Spectroscopy of Molecular Radicals

Azuma’s Ph.D. thesis research was done under the direction of J. T. Moseley at the University of Oregon. It concerned high resolution laser spectroscopy of gas phase molecular radicals, in particular metal containing diatomic molecules. He pursued this direction further as a postdoctoral fellow at the University of British Columbia (with A. J. Merer) and during his initial years at Argonne National Laboratory (with W. J. Childs). A variety of laser spectroscopic techniques employing the nonlinear response of gas phase samples were utilized to obtain ultra-high resolution spectra. In addition, double (multiple) resonance methods combining visible laser beams with radiofrequency, microwave, infrared, and vuv radiation were pursued. The main scientific motivation was to analyze the perturbations between the various electronic states as the vibration, rotation, and nuclear magnetic hyperfine structures come into play, and to understand the electronic structure of molecular radicals with an unpaired electron.

B. Atomic Photoionization Studies with Synchrotron Radiation

At Argonne, (1988 – 1994):

The construction of the Advanced Photon Source (APS) at Argonne National Laboratory motivated the exploration of the possibility of initiating an in-house research program on atomic physics with synchrotron radiation. During the planning and construction phase of the APS, together with Nora Berrah who was also at Argonne at that time, we collaborated with several groups including D. A. Church (ion traps, at NSLS), M.O. Krause (photo-electron spectroscopy, at SRC), B. Crasemann (absorption spectroscopy, at SSRL), I. A. Sellin (double photoionization of helium, at NSLS), and I also started my own absolute cross-section measurements (at NSLS). Although both Berrah and I left Argonne at a rather early stage, the research program thus initiated eventually led to the development of an active research group currently led by Steve Southworth.

At the Photon Factory (KEK), and at Sophia Univ. (1994-2021) and in India:

In 1994, I moved to the Photon Factory which was generally considered to be the best synchrotron radiation facility in the world at the time before third generation sources came around. My main research theme at the Photon Factory has been “multi-electron photo-effects of light atoms”. One could say this research direction has evolved directly from the first synchrotron radiation experiment ever, done by Madden and Codling on helium double photoexcitation in the 1960s, yet it does not fail to keep presenting interesting new developments today. I have been particularly interested in triply photo-excited states of lithium (hollow lithium), as well as the development of new experimental methods including time resolved fluorescence detection, metastable atoms detection, and excitation in a static external field. Theoretically these concerned the structure of multi-electron excited atomic states. Research continued as a user after moving to Sophia University and the experimental projects extended to UVSOR(IMS, Okazaki), ALS(LBL, Berkeley), Spring8(Harima) and SOLEIL(France). In recent years the emphasis has shifted to Post Collision Interaction (PCI) and photoelectron recapture upon inner-shell photionization. Theoretically they concern interactions in the multi-electron continua. The following are some of the highlights.

*The first systematic measurement and analysis of the spectrum of hollow lithium. (Azuma et al. PRL 1995, etc.).

*The first measurement of the doubly hollow (KL) lithium photoexcitation resonance (Azuma et al. PRL 1997).

*Triple photoionization of lithium: The behavior of cross-section in the threshold region showed interesting competition of shake-off signature and Wannier threshold law behavior (Wehlitz et al. PRL 1998 etc.).

*Identification and analysis of hollow lithium decay processes such as “one-step simultaneous”, “two step sequential”, “two-down one-out”, and most recently, “fluorescence” (Wehlitz et al. PRA RC 1999, etc.).

*Double photo excitation of helium in a strong static electric field (Harries et al. PRL 2003 etc.).

*Development of the Lifetime Resolved Fluorescence Spectroscopy (LRFS) technique (Harries et al. JPB 2003 etc.).

*Triple photoexcitation of beryllium (Hasegawa et al. PRL 2006 etc.)

*Time resolved fluorescence studies upon innershell excitations. (Suzuki et al J.Phys B 2016, Harries et al PRL 2018, etc.)

* Fluorescence Time Delay in Multistep Auger Decay as an Internal Clock (Kosugi et al PRL 2020)

*Initiated new developments in post-collision interactions and photoelectron recapture upon threshold photoionization. Extended the concept to include angular correlation, multi-step phenomena and time resolved studies extending to “ultra-fast Science”. (Phys Rev. Lett. 2020, J. Phys. B 2015, 2019, 2020, Phys. Scr. 2021, Phys. Rev. A. 2020, 2022, 2023 etc).

Yoshiro AZUMA

Refereed Journal Publications

S. Kosugi, F. Koike, M. Iizawa, F. Hosseini, J. Martins, T. Marchenko, O. Travnikova, J. D. Bozek, K. Ito, S. Fritzsche, M. N. Piancastelli, M. Simon, and Y. Azuma
“Strong configuration-interaction contributions to the angle-resolved 4p photoelectron spectra of atomic xenon”
Phys. Rev. A **107**, 022814 (2023)

S. Kosugi, R. Guillemin, O. Travnikova, T. Marchenko, D. Koulentianos, J.B. Martins, F. Hosseini, R. Püttner, D. Céolin, L. Journel, M.N. Piancastelli, I. Ismail, F. Koike, M. Iizawa, S. Sheinerman, L. Gerchikov, Y. Azuma, and M. Simon
“Postcollision-interaction effects in multistep Auger transitions following Ar 1s photoionization”
Phys. Rev. A **106**, 033114 (2022)

Masatomi Iizawa, Satoshi Kosugi, Fumihiro Koike, and Yoshiro Azuma
“The quantum and classical Fano parameter q ”
Phys. Scr. **96** 055401 (2021)

S. Kosugi, F. Koike, M. Iizawa, M. Oura, T. Gejo, K. Tamasaku, J.R. Harries, R. Guillemin, M.N. Piancastelli, M. Simon, and Y. Azuma
“Fluorescence Time Delay in Multistep Auger Decay as an Internal Clock”
Phys. Rev. Lett. **124**, 183001 (2020)

S. Kosugi, Y. Azuma et al.
“Strong configuration interaction in the 3p photoelectron spectrum of Kr”
Phys. Rev. A **101**, 042505 (2020)

S Kosugi, J Martins, F Hosseini, T Marchenko, O Travnikova, J D Bozek, K Ito, E Sokell, M N Piancastelli, M Simon, F Koike, and Y Azuma,
“Conjugate photoelectron recapture peaks in the high resolution Auger electron spectra following near threshold Ar 2p photoionization”
J. Phys. B: At. Mol. Opt. Phys. **53** 125001 (2020)

S Kosugi, N Suzuki, N Kumagai, H Iwayama, E Shigemasa, F Koike and Y Azuma
“Dominance of angular momentum exchange in the PCI recapture of photoelectrons revealed by high resolution Auger electron measurements of Kr”
J. Phys. B: At. Mol. Opt. Phys. **52** 245002 (2019)

James R. Harries, Hiroshi Iwayama, Susumu Kuma, Masatomi Iizawa, Norihiro Suzuki, Yoshiro Azuma, Ichiro Inoue, Shigeki Owada, Tadashi Togashi, Kensuke Tono, Makina Yabashi, and Eiji Shigemasa
“Superfluorescence, Free-Induction Decay, and Four-Wave Mixing: Propagation of Free-Electron Laser Pulses through a Dense Sample of Helium Ions”
Phys. Rev. Lett. **121**, 263201 (2018)

Norihiro Suzuki, Satoshi Kosugi, Yumi Ito, Naoki Inoue, Tatsuro Nagoshi, Nobuhiko Kuze, James R Harries, James P Sullivan, Tetsuo Nagata, Emma Sokell, Fumihiro Koike and Yoshiro Azuma
“Probing electron correlation through radiative lifetime measurements upon inner-valence photoionization of Ne and Ar” ,
Journal of Physics B: Atomic, Molecular and Optical Physics (2016)

Satoshi Kosugi, Masatomi Iizawa, Yu Kawarai, Yosuke Kuriyama, A L David Kilcoyne, Fumihiro Koike, Nobuhiko Kuze, Daniel S Slaughter, Yoshiro Azuma “PCI effects and the gradual formation of Rydberg series due to photoelectron recapture, in the Auger satellite lines upon Xe 4d $-1\ 5/2$ photoionization” *Journal of Physics B Atomic Molecular and Optical Physics* (2015)

Y. Kawarai, Th. Weber, Y. Azuma, C. Winstead, V. McKoy, A. Belkacem, D. S. Slaughter: “Dynamics of the Dissociating Uracil Anion Following Resonant Electron Attachment”. *Chemical Physics Letters* 2014/10

T Nagata, K Kawajiri, S Kosugi, N Suzuki, M Kemmotsu, T Nandi, E Sokell, F Koike, Y Azuma “Photoion spectroscopy on isolated Mn atoms in the 2p \rightarrow 3d excitation region. II. Decay processes of the excited states” *Journal of Physics B Atomic Molecular and Optical Physics* 2014/10

T Nagata, K Kawajiri, S Kosugi, N Suzuki, M Kemmotsu, T Nandi, E Sokell, Y Azuma, F Koike “Photoion spectroscopy on isolated Mn atoms in the 2p \rightarrow 3d excitation region: I. Total photoion-yield spectrum” *Journal of Physics B Atomic Molecular and Optical Physics* 2014/09

Shuichi Hasegawa, Satoshi Obara, Fumiko Yoshida, Yoshiro Azuma, Fumihiro Koike, Tetsuo Nagata “K-shell photoionization spectra of atomic beryllium between 1s2s2 and 1s (2s2p3P)4s” *Physical Review A Vol. 90* 032503 (2014)

T Osawa, K Kawajiri, N Suzuki, T Nagata, Y Azuma and F Koike
“Photoion-yield study of the 3p–3d giant resonance excitation region of isolated Cr, Mn and Fe atoms”
J. Phys. B: At. Mol. Opt. Phys. 45 225204 (2012)

G. Purohit, Prithvi Singh, Vinod Patidar, Y. Azuma, and K. K. Sud
“Effects of target polarization and postcollision interaction on the electron-impact single ionization of Ne(2p), Ar(3p), and Na(3s) atoms”
Phys. Rev. A 85, 022714 (2012)

James. R. Harries, T. Gejo, K. Homma, M Kuniwake, J P Sullivan, M Lebeck and Y Azuma
“Long-lived, highly excited neutral hydrogen atom production following oxygen 1s photoexcitation of gas-phase water molecules”
J. Phys. B: At. Mol. Opt. Phys. 44 095101 (2011)

S. Obara, R. Kobayashi, S. Yagi, Y. Tohyama, G. Kutluk, T. Osawa, K. Ogura, T. Shibata, Y. Azuma, T. Nagata
“A crossed photon atom beam method for absolute measurement of total photoionization cross-sections on isolated metal atoms: measurements on Ba and Eu atoms”
Nucl. Instrum. Method B **269** 263-271 (2011).

T Osawa, S Obara, T Nagata, Y Azuma and F Koike
“Observation and analysis of 3s-np resonance excitation in Cr, Mn and Fe atoms”
J. Phys. B: At. Mol. Opt. Phys. **42** 085005 (9pp) (2009)

T Osawa, Y Tohyama, S Obara, T Nagata, Y Azuma and F Koike
“ Photoabsorption and subsequent decay of Na and Mg atoms in the 2s-np autoionizing resonance region” *J. Phys. B: At. Mol. Opt. Phys.* **41** 245206(7pp) (2008)

Fumiko Yoshida, Fumihiko Koike, Satoshi Obara, Yoshiro Azuma, Tetsuo Nagata, and Shuichi Hasegawa "1s(2s2p ¹P)²Pnl, 1s(2s3s ^{3,1}S)²Snp, and 1s(2s3p ¹P)²Pns K-shell photoexcited Rydberg series of beryllium atoms" *Phys. Rev. A* **75**, 012714 (2007)

James R Harries, James P Sullivan, Peter Hammond and Yoshiro Azuma "Photoionization of He in the 3nl' doubly-excited state energy region: angular distribution of the fluorescence from the residual ion He⁺(2p)²P" *J. Phys. B: At. Mol. Opt. Phys.* **39** No 23 4819-4824 (2006)

Shuichi Hasegawa, Fumiko Yoshida, Leo Matsuoka, Fumihiko Koike, Stephan Fritzsche, Satoshi Obara, Yoshiro Azuma and Tetsuo Nagata "Photoexcitation of K-shell and L-shell Hollow Beryllium" *Phys. Rev. Lett.* **97**, 023001 (2006)

Fumiko Yoshida, Leo Matsuoka, Ryuta Takashima, Tetsuo Nagata, Yoshiro Azuma, Satoshi Obara, Fumihiko Koike and Shuichi Hasegawa "Analysis of 1s(2s2p ²P)nl Rydberg states in the K-shell photoionization of the Be atom" *Phys. Rev. A* **73**, 062709 (2006)

James R Harries, James P Sullivan, Satoshi Obara, Yoshiro Azuma, J G Lambourne, F Penent, R I Hall, P Lablanquie, K Bucar, M Zitnik and Peter Hammond "Partial photoionization of helium into the 2s²S and 2p²P ion states in the 3nl' doubly-excited states region" *J. Phys. B: At. Mol. Opt. Phys.* **38** No 10 L153-L160 (2005)

James R. Harries, and Yoshiro Azuma "Apparatus for measuring static electric field effects in photoexcitation experiments of gas-phase atoms and molecules using synchrotron radiation" *Rev. Sci. Instr.* **75** (11) 4406 (2004)

James R. Harries, James P. Sullivan, and Yoshiro Azuma "Experimental determination of the lifetimes of the 2(1,0)0n '2pnd'(1Po) doubly excited states of helium by detection of VUV fluorescence"

James R. Harries, James P. Sullivan, Satoshi Obara, Peter Hammond, and photoionization cross-sections using lifetime-resolved fluorescence spectroscopy" *J. Phys. B* **36**(19) L319 (2003)

James R. Harries, James P. Sullivan, James B. Sternberg, Satoshi Obara, Tadayuki Suzuki, Peter Hammond, John Bozek, Nora Berrah, Monica Halka and Yoshiro Azuma "Double Photoexcitation of Helium in a Strong dc Electric Field" *Phys. Rev. Lett.* **90** (13) 133002 (2003)

Michi Koide, Fumihiko Koike, Tetsuo Nagata, Jon C. Levin, Stephan Fritzsche, Ralf Wehlitz, Ming-Tie Huang, Brett D. Depaola, Shunsuke Ohtani, and Yoshiro Azuma "Common Window Resonance Features in K and Heavier Alkaline Atoms Rb and Cs" *J. Phys. Soc. Jpn.* **71** (11) 2681 (2002)

Michi Koide, Fumihiro Koike, Ralf Wehlitz, Ming-Tie Huang, Tetsuo Nagata, Jon C. Levin, Stephan Fritsche, Brett D. Depaola, Shunsuke Ohtani, and Yoshiro Azuma
“New Window Resonances in the Potassium 3s Photoabsorption Spectrum”
J. Phys. Soc. Jpn. **71** (7) 1676 (2002)

M. Achler, V. Mergel, L. Spielberger, R. Dorner, Y. Azuma and H. Schmidt-Bocking
“Photo double ionization of He by circular and linear polarized single-photon absorption”
J. Phys. B **34** 965 (2001)

R. Wehlitz, T. Pattard, M.-T. Huang, I.A. Sellin, J. Burgdorfer, and Y. Azuma
“The Near-Threshold Triple-Photoionization Cross-Section of Lithium”
Phys. Rev. A **61** 030704(R) (2000)

R. Wehlitz, M.-T. Huang, I.A. Sellin, and Y. Azuma
“Wannier threshold law examined by photoelectron satellite measurements”
J. Phys. B **32** L635 – L641 (1999)

T. LeBrun, S.H. Southworth, G.B. Armen, M.A. MacDonald, and Y. Azuma
“Radiationless resonant Raman scattering at the Ar K edge”
Phys. Rev. A **60** (6) 4667 (1999)

R. Wehlitz, M.-T. Huang, K.A. Berrington, S. Nakazaki, and Y. Azuma
“One-step double-autoionization into the double-photoionization continuum”
Phys. Rev. A **60** (1) Rapid Communications R17 (1999)

M.-T. Huang, R. Wehlitz, Y. Azuma, T. Nagata, H. Ishijima, M. Koide,
L. Pibida, and I.A. Sellin,
“Single and double photoionization of lithium”
Phys. Rev. A **59** (5) 3397 (1999)

S.H. Southworth, T. LeBrun, Y. Azuma, and K.G. Dylla
“Argon KM photoelectron satellites”
J. Electron Spectroscop. **94** 33 (1998)

R. Wehlitz, M.-T. Huang, B.D. DePaola, J.C. Levin, I.A. Sellin, T. Nagata,
J.C. Cooper, and Y. Azuma, “Triple Photoionization of Lithium”
Phys. Rev. Lett. **31** (9) 1813 (1998)

V. Mergel, M. Achler, R. Dorner, Kh. Khayyat, T. Kambara, Y. Awaya,
V. Zoran, B. Nystrom, L. Spielberger, J.H. McGuire, J. Feagin, J. Berakdar,
Y. Azuma, and H. Schmidt-Bocking, “Helicity dependence of the photon-induced
three-body Coulomb fragmentation of helium investigated by COLTRIMS”
Phys. Rev. Lett. **80** (24) 5301 (1998)

Y. Ito, A.M. Vlaciuc, T. Tochio, T. Mukoyama, M. Takahashi, S. Emura, and Y. Azuma,
“X-ray absorption features from multielectron excitations above Xe-L edges”
Phys. Rev. A **57** (2) 873 (1998)

Y. Azuma, F. Koike, J.W. Cooper, T. Nagata, G. Kutluk, E. Shigemasa, R. Wehlitz, and I.A. Sellin “Photoexcitation of Hollow Lithium with Completely Empty K and L Shells”
Phys. Rev. Lett. **79** (13) 2419 (1997)

Y. Azuma, S. Hasegawa, F. Koike, G. Kutluk, T. Nagata, A. Yagishita, and I.A. Sellin
“New Photon-induced Triply Excited Hollow Atom States of Lithium”
Phys. Rev. Lett. **74** (19) 3768 (1995)

P.A. Hatherley, A. Yagishita, E. Shigemasa, J.-I. Adachi, Y. Azuma, and I.A. Sellin,
“The angular distribution of electrons from aligned core excited CO using angle
resolved PEPICO”
J. Phys. B **28** 2643 (1995)

M.A. Macdonald, S.H. Southworth, J.C. Levin, A. Hinnins, R.D. Deslattes, T. LeBrun,
Y. Azuma, P.L. Cowan, and B.A. Karlin “Evolution of x-ray resonance Raman
scattering into x-ray fluorescence from the excitation of xenon near the L3 edge”
Phys. Rev. A **51** (5) 3598 (1995)

Y. Azuma, H.G. Berry, D.S. Gemmell, J. Suleiman, M. Westerlind, I.A. Sellin,
J.C. Woicjik, and J.P. Kirkland “Attenuation of photons at 3– 14 keV energies in
helium”
Phys. Rev. A. **51** (1) 447 (1995)

H.G. Berry, Y. Azuma, P.L. Cowan, D.S. Gemmell, T. LeBrun, M. Ya Amusia “Ion
charge-state production and photoionization near the K-edge in argon and potassium”
Nucl. Instr. And Meth. B **98** 25 (1995)

A.G. Adam, Y. Azuma, J.A. Barry, A.J. Merer, U. Sassenberg, J.O. Schroeder, G. Cheval
and J.L. Feminias “Hyperfine structure in high spin multiplicity electronic states:
analysis of the $B^4\Pi - X^4\Sigma^-$ transition of gaseous NbO”
J. Chem. Phys. **100** (9) 6240 (1994)

Y. Azuma, G. Huang, M.P.J. Lyne, A.J. Merer, and V.I. Srdanov “Laser spectroscopy of
the low-lying electronic states of NbN: electron spin and hyperfine effects in the states
from the configurations $\sigma\delta$ and $\delta\pi$ ”.
J. Chem Phys. **100** (6) 4138 (1994)

J.C. Levin, I.A. Sellin, B.M. Johnson, D.W. Lindle, R.D. Miller, N. Berrah Mansour,
Y. Azuma, H.G. Berry, and D.-H. Lee,
“High Energy Behavior of the Double Photoionization of Helium from 2 to 12 keV”.
Phys. Rev. A **47**, Rapid Communications R16 (1993)

S.J. Schaphorst, S.B. Whitfield, H.P. Saha, C.D. Caldwell, and Y. Azuma
“Angle-resolved photoelectron spectrometry of atomic nitrogen”
Phys. Rev. A. **47** (4) 3007, (1993)

S.J. Schaphorst, A.F. Kodre, J. Ruschenski, B. Crasemann, T. Aberg, J. Tulkki,
M.H. Chen, Y. Azuma, and G.S. Brown, “Multielectron inner-shell photoexcitation in
the absorption spectra of Kr: theory and experiment”.
Phys. Rev. A. **47** (3) 1953 (1993)

S.D. Kravis, D.A. Church, B.M. Johnson, M. Meron, K.W. Jones, J.C. Levin, I.A. Sellin, Y. Azuma, N. Berrah Mansour, H.G. Berry, and M. Druetta, “Inner Shell Photoionization of Stored Positive Ions Using Synchrotron Radiation” *Phys. Rev. Lett.* **66** (23) 2956 (1991)

Y. Azuma, W.J. Childs, and K.L. Menningen, “Doppler-Free Laser Spectroscopy of CeF and Observation of Hyperfine Structure” *J. Mol. Spectrosc.* **145** 413, (1991).

A.G. Adam, Y. Azuma, Huai Li, A.J. Merer and T. Chandrakumar, “Anomalous structure in the $A^6\Sigma^+ - X^6\Sigma^+$ transition of MnO caused by interference between two internal hyperfine perturbations”. *Chemical Physics* **152** 391 (1991)

D.A. Church, S.D. Kravis, B.M. Johnson, Y. Azuma, J.C. Levin, I.A. Sellin, M. Meron, K.W. Jones, M. Druetta, N. Mansour, H.G. Berry, and R.T. Short, “Electron transfer collision studies on stored ions produced by synchrotron radiation”. *Nucl. Instr. And Meth. B* **56/57** 417 (1991)

S.D. Kravis, D.A. Church, B.M. Johnson, J.C. Levin, Y. Azuma, I.A. Sellin, M. Meron, K.W. Jones, M. Druetta, N. Mansour, H.G. Berry, and R.T. Short, “Sequential photoionization of ions using synchrotron radiation and a Penning trap”. *Nucl. Instr. And Meth B* **56/57** 396 (1991)

Y. Azuma and W.J. Childs, “Spin-rotation and Hyperfine Structure in the $X^2\Sigma^+$ State of Yttrium Monosulfide by Molecular-beam Laser-rf Double Resonance”. *J. Chem Phys.* **93** (12) 8415 (1990)

Y. Azuma, W.J. Childs, G.L. Goodman and T.C. Steimle, “The fine and magnetic hyperfine structure of ^{87}SrF in its $X^2\Sigma^+$ state” *J. Chem Phys.* **93** (8) 5533 (1990)

W.J. Childs, Y. Azuma and G.I. Goodman, “Hyperfine Structure in the Two Lowest Electronic States of PrO by Molecular-Beam Laser-rf Double Resonance”. *J. Mol. Spectrosc.* **144** 70 (1990)

C.-J. Liu, N.B. Mansour, Y. Azuma, H.G. Berry, D.A. Church, and R.W. Dunford, “Electron-Polarized N^{4+} Ion Beam Formed by Electron Capture to N^{5+} in a Polarized Sodium Target”. *Phys. Rev. Lett.* **64** (12) 1354 (1990)

R.W. Dunford, C.-J. Liu, N.B. Mansour, Y. Azuma, H.G. Berry, D.A. Church, T.P. Dinneen, L. Young, and B.J. Zabransky, “Polarized Targets for Atomic Physics Experiments with Highly Charged Ions”. *Nucl. Instr. And Meth. B* **43** 459, (1989)

Y. Azuma, J.A. Barry, M.P.J. Lyne, A.J. Merer, J.O. Schroeder and J.-L. Feminias, “Spin-orbit distortion of the hyperfine structure in heavier molecules: Breakdown of the case (ab) formalism in the $B^3\Phi - X^3\Delta$ system of gaseous NbN” *J. Chem Phys.* **91** (1) 1 (1989)

Y. Azuma and A.J. Merer, "Optical-Optical Double Resonance Measurements of the Lowest Spin-Orbit Interval in FeO"
J. Mol. Spectrosc. **135** 194 (1989)

A.G. Adam, Y. Azuma, J.A. Barry, G. Huang, M.J. Lyne, A.J. Merer, and J.O. Schroeder,
"A laser-induced fluorescence study of bands of the red system of gaseous CoO:
Evidence for a $4\Delta_i$ ground state"
J. Chem Phys. **86** (10) 5231 (1987)

"Puzzling Diatomic Features Solved by Laser-Spectroscopy." A.J. Merer, U. Sassenberg,
Y. Azuma, J.O. Schroeder, J.A. Barry, A.G. Adam, G. Cheval and J.-L. Femenias. J. Phys.
(Paris) Colloq. **48**, C7, p. 667-669 (1987).

Y. Azuma, T.R. Dyke, G.K. Gerke, and T.C. Steimle,
"Laser Induce Fluorescence and Microwave-Optical Double-Resonance Study of the
 $B^1\Sigma^+ - X^1\Sigma^+$ System of Magnesium Monoxide"/
J. Mol. Spectrosc. **108** 137 (1984)

T.C. Steimle, Y. Azuma and P.G. Carrick,
"Laboratory Measurements of the Millimeter-wave Spectrum of Magnesium Monoxide"
Astrophysical Journal **277**, L21-L22 (1984)