2019 UNISOKU NEWSLETTER

Atomically-resolved STM image of FeSe,
applied for The Guinness Book of Records,
claiming as the image resolving the greatest number of atoms (~1.1 million) in human history,
by courtesy of Dr. Tetsuo Hanaguri (RIKEN).

45th Anniversary History of UNISOKU

1974

Toshihiko Nagamura founded Union Instruments Co., Ltd
長村俊彦 (初代) 社長が株式会社ユニオン測器を創業 (11 月)

Automatic polarimeter
自動旋光計　RM-101

High sensitivity differential refractometer
高感度示差屈折計　RM-102

Eisaku Sato (Nobel Peace Prize)
佐藤栄作氏 ノーベル平和賞 受賞

1981

Union Instruments Co., Ltd was renamed UNISOKU Co., Ltd
株式会社ユニオン測器から株式会社ユニソクに社名変更 (10 月)

Gas-pressure based stopped-flow
spectroscopy system　RA-401
ガス圧方式を採用したストップトフロー分光システム

Kenichi Fukui (Nobel Prize in Chemistry)
福井謙一氏 ノーベル化学賞 受賞

1982 First atomic-scale imaging by Gerd Binnig and Henrich Rohrer using STM
1982 年 Gerd Binnig と Heinrich Rohrer が初めて STM で原子像を観測する事に成功

1985 AFM invented by G. Binnig
1985 年 G. Binnig が AFM を発明

1986

Started sales of ambient STM system for the first time in Japan
大気中で使用する国産初の走査型トンネル顕微鏡を完成、販売開始

1st UNISOKU STM
USM -101
ユニソク最初の STM

1st UNISOKU
STM data
ユニソク最初の STM 像

G. Binnig and H. Rohrer won Nobel Prize in Physics for STM invention
G. Binnig と H. Rohrer が STM 発明の功績によりノーベル物理賞 受賞

1987 Susumu Tonegawa (Nobel Prize in Physiology or Medicine)
1987 年 利根川進氏 ノーベル生理学・医学賞 受賞

1989

Productized Ultra High Vacuum STM systems and started sales
超高真空 STM 装置を製品化、販売開始

Ultra High Vacuum STM　USM-301U
超高真空 STM

Productized Ultra High Vacuum Low Temperature STM systems and started sales
超高真空低温 STM を製品化、販売開始

1991

Ultra High Vacuum
Low Temperature
STM system　USM-501
超高真空低温 STM

Ultra High Vacuum
Low Temperature
STM system　USM-602
超高真空低温 STM

1994 Kenzaburo Oe (Nobel Prize in Literature)
1994 年　大江健三郎氏 ノーベル文学賞 受賞

1998

New company building (current head office) completed in Kasugano, Hirakata city
枚方市春日野に新社屋完成

1999

Started sales of 2K High Magnetic Field STM
2K 磁場中 STM の販売開始

Started sales of Low Temperature Spectrophotometer Cell (later named as CoolSpeK)
分光光度計用低温セル室 (のちに CoolSpeK と命名) を販売開始

Ahmed H. Zewail won Nobel Prize in Chemistry for his work in femtochemistry.
Ahmed. H. Zewail がフェムト秒化学発展の功績に対しノーベル賞を受賞

2000 Hideki Shirakawa (Nobel Prize in Chemistry)
2000 年　白川英樹氏 ノーベル化学賞 受賞

2001 Ryoji Noyori (Nobel Prize in Chemistry)
2001 年　ユーザーの野依良治氏 ノーベル化学賞 受賞

2002

Productized 400mK Very Low Temperature　STM and started sales
400mK 極低温 STM の製品化、販売開始

1st President, Toshihiko Nagamura was commended for “Technological Achievement Award” from The Japan Society for Analytical Chemistry for the development of fast reaction analysis/nanoscale surface analysis
長村俊彦社長　高速反応解析・ナノスケール表面分析装置の開発の功績で 日本分析化学会技術功績賞受賞

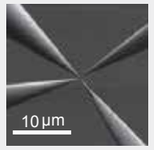
2004

30th Annive rsary of the founding
創立 30 周年を迎え る

Started sales of Ultra High Vacuum Low Temperature SPM systems (USM-1400 series)
超高真空極低温 SPM システム USM-1400 シリーズを販売開始

2006 2007

At Nano Tech 2006, UNISOKU won “Nanotechnology Grand Prize” for developing SPM systems
Nano Tech 2006 において自社技術による走査型プローブ顕微鏡 出展に対しナノテク大賞「評価・計測部門」受賞



1st President, Toshihiko Nagamura was awarded from Osaka for developing very low temperature SPM systems
長村俊彦社長、極低温走査型プローブ顕微鏡の考案の功績で 大阪府新技術開発功労者　受賞

2008 Yoichiro Nambu, Makoto Kobayashi and Toshihide Masukawa (Nobel Prize in Physics)
2008年　南部陽一郎・小林誠・益川敏英の3氏 ノーベル物理学賞 受賞

Osamu Shimomura (Nobel Prize in Chemistry)
下村脩氏 ノーベル化学賞 受賞

2010

UNISOKU bec ame a part of TII group, Shoji Suruga was 2nd President Toshihiko Nagamura was inaugurated as
inaugurated as 1st President, Chairman
株式会社ユニソクは株式 会社東京インスツルメンツのグループ会社に
駿河正次が第二代 代表 取締役社長に就任　長村俊彦初代社長は会長に

2011 2012

UNISOKU-TII Co., Ltd. in Beijing esta blished as a local corporation
北京に現地法人 UNISOKU-TII 有限公司を設立

Capital stock increased from 25 million yen to 50 million yen
資本金 2,500 万円から 5,000 万円へ増資

1st Factory completed to increase production capability
生産能力拡大の為第一工場完成

Started sales of 40mK-STM (USM1600)
40mK - STM(USM1600) を販売開始

2013

Toshihiko Nagamura (1st President) retired Chairman
長村俊彦会長（初代社長）が勇退

40th Anniv ersary of the founding Company t rip to Malaysia
ユニソク 40 周年　記念　マレーシア社員旅行

2014 2015

Chosen as a “GLOBAL NICHE TOP100” company by the Ministry of Economy, Trade and Industry
経済産業省から「グローバルニッチトップ企業 100 選」に選定

Isamu Akasaki, Hiroshi Am ano and Shuji Nakamura (Nobel Prize in Physics)
赤崎勇氏、天野浩氏、中村修二氏 ノーベル物理学賞 受賞

Started sales of Tip Enhanced Raman Spectroscopy SPM (USM1400-TERS)
Tip Enhanced Raman Spectroscopy 性能を搭載した SPM、 USM1400-TERS を販売開始

Satoshi Omura (Nobel Prize in Physiology or Medicine)
大村智氏 ノーベル生理学・医学賞 受賞

Takaaki Kajita (Nobel Prize in Physics)
梶田隆章氏 ノーベル物理学賞 受賞

2016

1st UNISOKU NewsLetter published
UNISOKU News Letter 第一号創刊

The Nikkei wrote an article about exp ort expansion of UNISOKU
ユニソクの輸出拡大が「日本経済新聞」に掲載

2nd Factory completed to improve working environment and double the production capacity
第二工場完成　生産能力 2.5 倍、作業環境を改善

2nd President, Shoji Suruga won the s pecial prize of “The 14th Courageous Management Awards ” as Chairman o f Tokyo Instruments Inc.
駿河正次社長「第 14 回勇気ある経営大賞」で東京インスツ ルメンツ代表取締役会長として「特別賞」受賞

2016

UNISOKU won “Technology Award” from The Japanese Photochemistry Association for developing RIPT method and its production
RIPT 法の考案と製品化により光化学協会技術賞を受賞

Yoshinori Osumi (Nobel Prize in Physiology or Medicine)
大隅良典氏 ノーベル生理学・医学賞 受賞

2017

UNISOKU was introduced in “Potentiality in Kansai Area” on Asahi Shimbun
朝日新聞「近畿の底ぢから」にユニソク記事掲載

TII group and SPECS founded a joint venture “SPECS-TII Gmbh” in Switzerland
TII グループと SPECS がスイスに合弁会社「SPECS-TII Gmbh」を設立

USM 1400-TERS won the award for excellence at “The 29th New Technologies and Products Award for small and medium enterprises”
USM1400-TERS が第 29 回「中小企業優秀新技術・新製品賞」で「優秀賞」受賞

The mayor of Hirakata city made a courtesy visit to UNISOKU
枚方市長がユニソクへ表敬訪問

Succeeded in RIPT method productization supported by JST “Development of Advanced Measurement and Analysis Systems” and started sales of picoTAS
JST 先端計測機器開発により RIPT 法の製品化に成功、picoTAS を販売開始

2nd President, Shoji Suruga passed away
駿河正次社長が 10 月 21 日に急逝

Yutaka Miyatake is inaugurated as 3rd President
宮武優が第三代 代表取締役社長に就任

Holding time of liquid helium in LT-UHV STM (USM 1200) greatly improved
LT-UHV STM USM1200 を刷新、液体ヘリウムの保持時間を飛躍的に伸ばす

Kazuo Ishiguro (Nobel Prize in Literature)
カズオ・イシグロ氏 ノーベル文学賞 受賞

2018

Legal registration of SPECS-TII. RUS and SPECS-TII. Beijing was completed
SPECS-TII. RUS と SPECS-TII. Beijing が公式法人登録

Group photo in 2nd Factory
第二工場内にて

Tasuku Honjo (Nobel Prize in Physiology or Medicine)
本庶佑氏 ノーベル生理学・医学賞 受賞

創業四十五周年によせて

To the 45 th anniversary of our foundation

Yutaka Miyatake
宮武　優（代表取締役社長）

Toshihiko Nagamura
長村　俊彦（創業者・元会長）

Since UNISOKU was founded, our motto has been “Contribute to the progress in science and technology by developing unique instruments in collaboration with customers”. I hope UNISOKU will continue this policy to respond to expectations from customers all around the world.

ユニソク創業時のモットーは“顧客と共同してユニークな製品を開発し、科学技術の発展に貢献する”であった。今後も世界の研究者の期待に応える製品の開発を継続してほしい。

(Founder and Former Chairman) ***Toshihiko Nagamura***

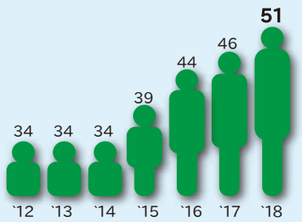
UNISOKU is delighted to contribute to society by offering products that could help customers to achieve fruitful results for advancing science and technology. For that purpose, we will constantly challenge to develop unique instruments. To support our customers for a long term, I devote myself to build a 100-year company.

我々の技術と経験をもとに装置づくりに挑戦しつづけ、お客様から科学技術の発展につながる成果が出ること、これがユニソクの喜びです。皆様に安心していただけるよう、100 年続く会社をめざしユニソクを継承してゆきます。

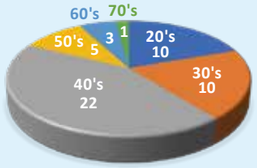
(President and CEO) ***Yutaka Miyatake***

Company Information

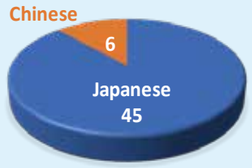
THE NUMBER OF MEMBERS

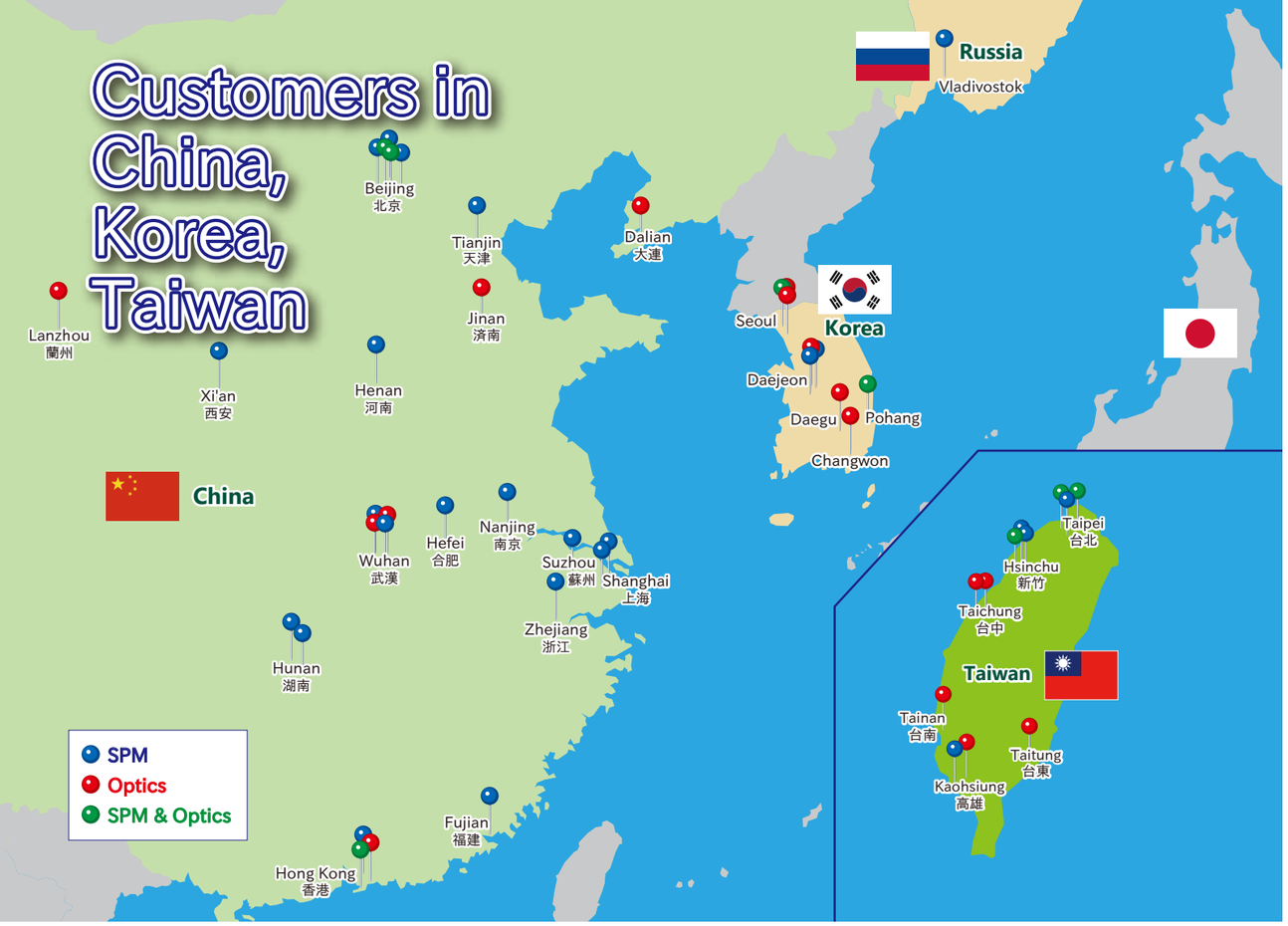


AGE GROUP



NATIONALITY





Publication List From This Region (Selected)

USM1200

"Structural and Electronic Effects of Adatoms on Metallic Atomic Chains in Si(111)5 × 2-Au"
E. H. Do *et al.*, Sci. Rep. **8**, 15537 (2018).

"Adsorption and Assembly of Photoelectronic TiOPc Molecules on Coinage Metal Surfaces"
W. Zhao *et al.*, J. Phys. Chem. C **122**, 14, 7695 (2018).

USM1300

"Evidence for Majorana Bound States in an Iron-Based Superconductor"
D. Wang *et al.*, Science **362**, 333 (2018).

"Sign Reversal of the Order Parameter in $(Li_{1-x}Fe_x)OHFe_{1-y}Zn_ySe$"
Z. Du *et al.*, Nat. Phys. **14**, 134 (2018).

"Direct Observation of Semiconductor–Metal Phase Transition in Bilayer Tungsten Diselenide Induced by Potassium Surface Functionalization"
B. Lei *et al.*, ACS Nano **12**, 2070 (2018).

"Detection and Manipulation of Charge States for Double-Decker $DyPc_2$Molecules on Ultrathin CuO Films"
Y. Zhang *et al.*, ACS Nano **12**, 2991 (2018).

"Fabrication of Millimeter-Scale, Single-Crystal One-Third-Hydrogenated Graphene with Anisotropic Electronic Properties"
H. Chen *et al.*, Adv. Mater. **30**, 1801838 (2018).

"Discrete Energy Levels of Caroli-de Gennes-Matricon States in Quantum limit in $FeTe_{0.55}Se_{0.45}$"
M. Chen *et al.*, Nat. Commun. **9**, 970 (2018).

"Superconductivity with Twofold Symmetry in $Bi_2Te_3/FeTe_{0.55}Se_{0.45}$ Heterostructures"
M. Chen *et al.*, Sci. Adv. **4**, eaat1084 (2018).

"Edge States at Nematic Domain Walls in FeSe Films"
Y. Yuan *et al.*, Nano Lett. **18**, 7176 (2018).

"Nontrivial Superconductivity in Topological $MoTe_{2-x}S_x$ Crystals"
Y. Li *et al.*, Proc. Natl. Acad. Sci. USA **115**, 9503 (2018).

Introduction of Researcher:
Shaochun Li (Nanjing University)

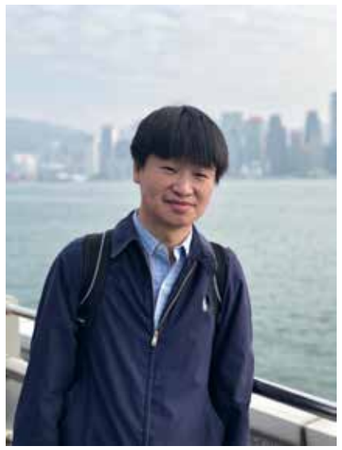
USM1500,1600

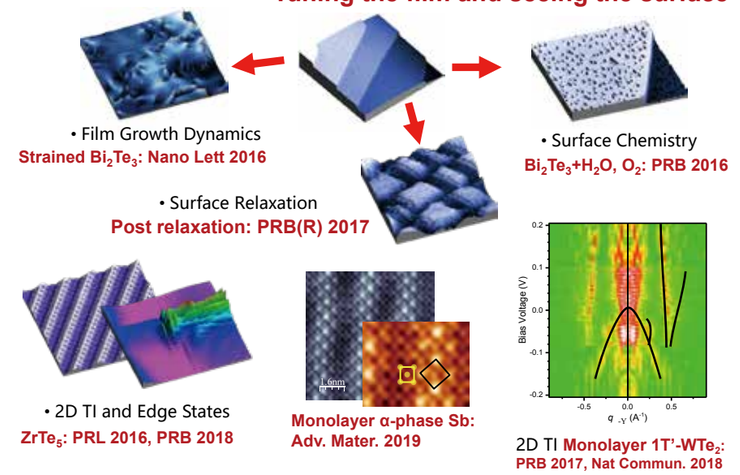
■ General introduction to our group

I started to set up my lab at Nanjing University in 2013. The current research interest in our group is topological materials. We tried to grow thin films or monolayered topological insulators with molecular beam epitaxy and look at the surface with scanning tunneling microscopy. Meanwhile, we also tune the films properties by tuning the growth kinetics.

■ Introduction of study utilizing Unisoku system

Monolayer 1T'-WTe_2 is a candidate of quantum spin Hall material, and has been attracting great attentions. However, to precisely determine the band structure near Fermi energy is out of the resolution scale of ARPES. STM quasiparticle interference (QPI) provides a high resolution way to map out the constant energy contour. In a recent paper, we grew monolayer 1T'-WTe_2 on bilayer SiC substrate and systematically imaged the QPI. We undoubtedly figured out the bulk band is semimetal like with no full SOC gap, and we also found a Coulomb gap opened at Fermi energy due to the electron-electron interactions.





USM1400

"Modulating the Electronic Properties of Graphene by Self-Organized Sulfur Identical Nanoclusters and Atomic Superlattices Confined at an Interface"
D. Ma *et al.*, ACS Nano **12,** 10984 (2018).

"Landau Quantization of a Narrow Doubly-Folded Wrinkle in Monolayer Graphene"
C. Ma *et al.*, Nano Lett. **18**, 6710 (2018).

"Fabrication of Metal/Graphene Hybrid Interconnects by Direct Graphene Growth and Their Integration Properties"
C. S. Lee *et al.*, Advanced Electronic Materials **4**, 1700624 (2018).

USM1600

"Enhanced Spontaneous Polarization in Ultrathin SnTe Films with Layered Antipolar Structure"
K. Chang *et al.*, Adv. Mater. **31**, 1804428 (2019).

"Quasiparticle Interference and Nonsymmorphic Effect on a Floating Band Surface State of ZrSiSe"
Z. Zhu *et al.*, Nat. Commun. **9**, 4153 (2018).

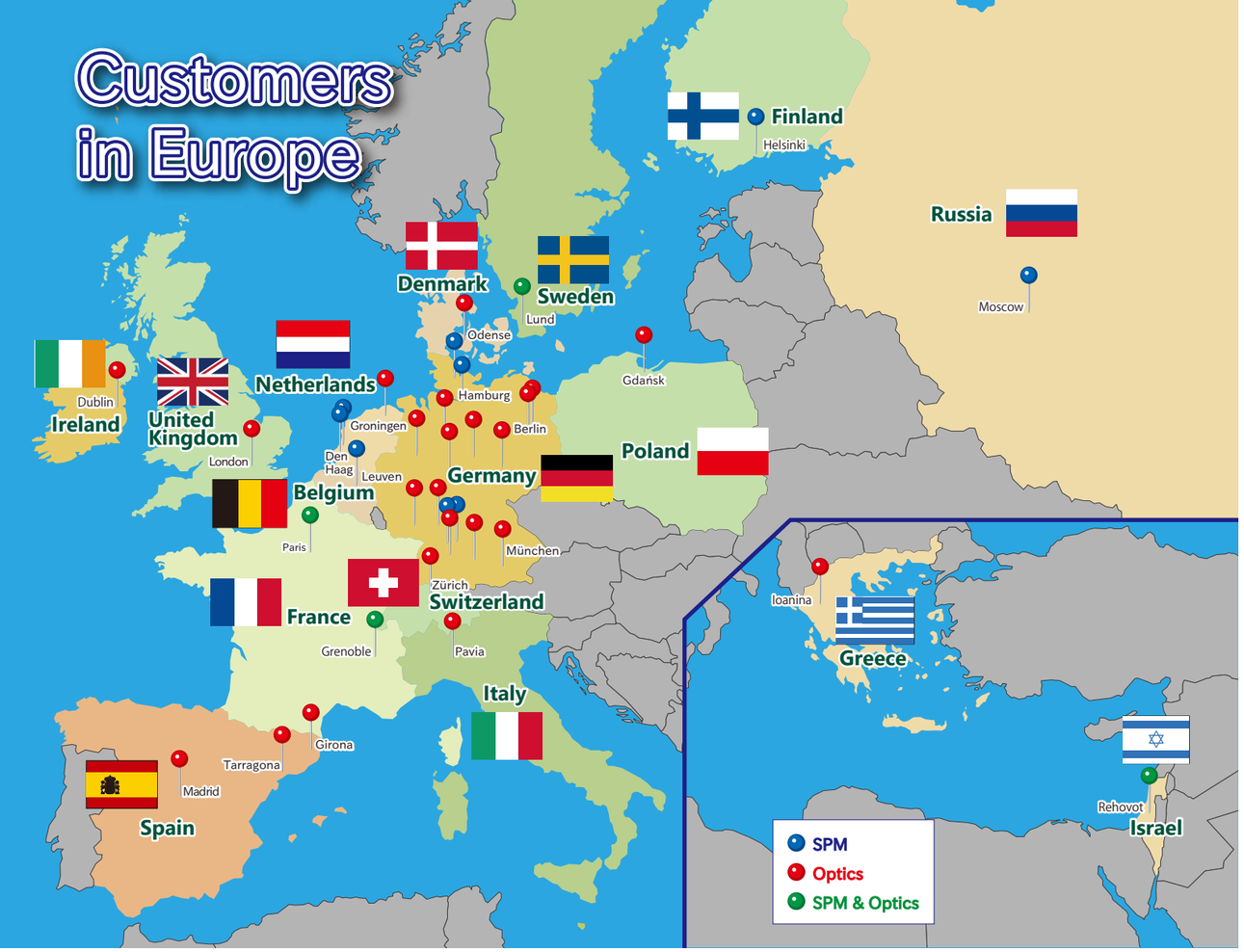
"Observation of Coulomb Gap in the Quantum Spin Hall Candidate Single-layer 1T'-WTe_2"
Y. H. Song *et al.*, Nat. Commun. **9**, 4071 (2018).

CoolSpek

"Redox Reactivity of a Mononuclear Manganese-Oxo Complex Binding Calcium Ion and Other Redox-Inactive Metal Ions"
M. Sankaralingam *et al.*, J. Am. Chem. Soc. **141**,1324 (2019).

"Mechanistic Insights into the Enantioselective Epoxidation of Olefins By Bioinspired Manganese Complexes: Role of Carboxylic Acid and Nature of Active Oxidant"
J. Du *et al.*, ACS Catal. **8**, 4528 (2018).

"A Mononuclear Nonheme $\{FeNO\}^6$ Complex: Synthesis And Structural And Spectroscopic Characterization"
S. Hong *et al.*, Chem. Sci. **9**, 6952 (2018).



Publication List From This Region (Selected)

USM1300

"Coupled Yu–Shiba–Rusinov States in Molecular Dimers on $NbSe_2$"
S. Kezilebieke *et al.*, Nano Lett. **18**, 2311 (2018).

"Toward tailoring Majorana Bound States in Artificially Constructed Magnetic Atom Chains on Elemental Superconductors"
H. Kim *et al.*, Sci. Adv. **4**, eaar5251 (2018).

"Scanning Tunneling Spectroscopy Investigations of Superconducting-Doped Topological Insulators: Experimental Pitfalls and Results"
S. Wilfert *et al.*, Phys. Rev. B **98**, 085133 (2018).

USM1500

"Weak Antilocalization at the Atomic-Scale Limit of Metal Film Thickness"
A. V. Matetskiy *et al.*, Nano Lett. **19**, 570 (2019).

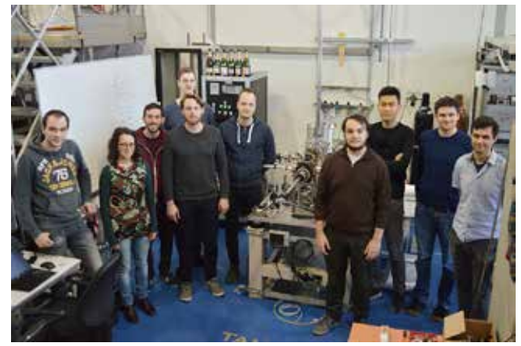
CoolSpek

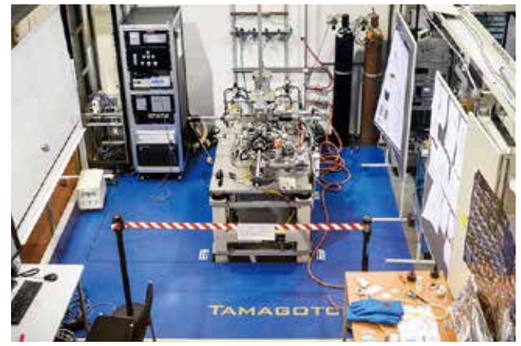
"Reductive O_2 Binding at a Dihydride Complex Leading to Redox Interconvertible μ-1,2-Peroxo and μ-1,2-Superoxo Dinickel(II) Intermediates"
P. C. Duan *et al.*, J. Am. Chem. Soc. **140**, 4929 (2018).

"Catalytic Alkyl Hydroperoxide and Acyl Hydroperoxide Disproportionation by a Nonheme Iron Complex"
C. Wegeberg *et al.*, ACS Catal. **8**, 9980 (2018).

Milan Allan (Leiden University)

USM1500





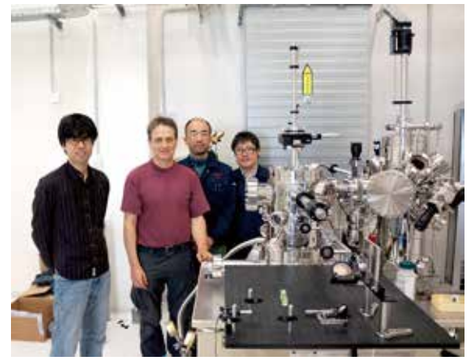
We are a research group at the Leiden Institute of Physics. We work hard to explore and understand quantum materials, including strange metals, high-temperature superconductors, and quantum critical electron matter. Recently, we have focused on cuprate and iron-based high-temperature superconductors. We always want to combine novel science and instrumental development. For example, we modified our UNISOKU USM1500 to include shot-noise capabilities with a low-temperature amplifier developed in our group **[1]**.
This allowed us to make new discoveries on cuprate superconductors **[2]** and we believe that there is much more to come.
We are now working with UNISOKU to make this amplifier more widely available. In parallel, we are working on Josephson tunneling, and — together with our Leiden theory colleagues — on experimental tests of the AdS/CFT correspondence in strange metals. You can find more information on allanlab.org.

[1] "Amplifier for Scanning Tunneling Microscopy at MHz Frequencies"
K. M. Bastiaans *et al.*, Rev. Sci. Instrum., **89,** 093709 (2018).

[2] "Charge Trapping and Super-Poissonian Noise Centres in a Cuprate Superconductor"
K. M. Bastiaans *et al.*, Nat. Phys. **14**, 1183 (2018).

Takashi Kumagai (Fritz-Haber Institute of The Max Planck Society)

USM1400



Research Interests

- Direct observation of hydrogen bond dynamics
- Force-induced chemical reaction
- Tip-enhance Raman spectroscopy
- Ultrathin zinc oxide films

Recent result

S. Liu, M. Wolf, and T. Kumagai, Phys. Rev. Lett. **121**, 226802 (2018).

We have developed a low-temperature scanning probe microscope equipped with original in-situ optics for local optical excitation and spectroscopy. Using this new instrument, we observed plasmon-assisted resonant electron tunneling from a silver or gold tip to field emission resonances (FERs) of a Ag(111) surface induced by continuous-wave laser excitation of a scanning tunneling microscope (STM) junction at visible wavelengths (Fig. 1). As a hallmark of the plasmon-assisted resonant tunneling, a downshift of the first peak in the FER spectra by a fixed amount equal to the incident photon energy is observed (Fig. 2). The STM-induced luminescence measurement for the silver and gold tip reveals the clear correlation between the laser-induced change in the FER spectra and the plasmonic properties of the junction. These results clarify a novel resonant electron transfer mechanism in a plasmonic nanocavity.

Fig.1

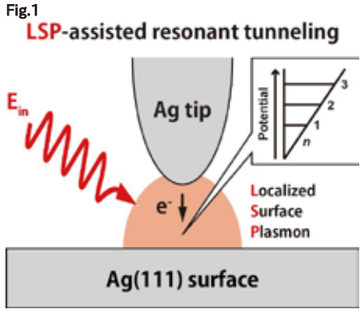
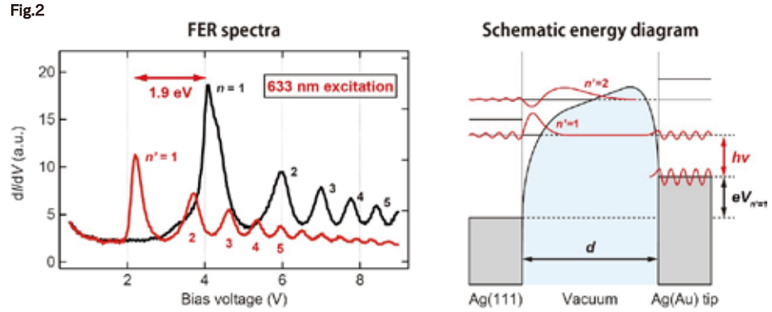


Fig.2



Publication List From This Region (Selected)

USM1300

"Giant and Anisotropic Many-Body Spin–Orbit Tunability in a Strongly Correlated Kagome Magnet"
J. Ying *et al.*, Nature **562**, 91 (2018).

"Interplay of Orbital Effects and Nanoscale Strain in Topological Crystalline Insulators"
D. Walkup *et al.*, Nat. Commun. **9**, 1550 (2018).

"Bursting at the Seams: Rippled Monolayer Bismuth on $NbSe_2$"
A. Fang *et al.*, Sci. Adv. **4**, eaaq0330 (2018).

"Disorder Induced Power-Law Gaps in an Insulator–Metal Mott Transition"
Z. Wang *et al.*, Proc. Natl. Acad. Sci. USA **115**, 11198 (2018).

USM1400 TERS

"Dual Binding Configurations of Subphthalocyanine on Ag(100) Substrate Characterized by Scanning Tunneling Microscopy, Tip-Enhanced Raman Spectroscopy, and Density Functional Theory"
P. J. Whiteman *et al.*, J. Phys. Chem. C **122**, 5489 (2018).

USM1400 4P

"Accessing the Intrinsic Spin Transport in a Topological Insulator by Controlling the Crossover of Bulk-to-Surface Conductance"
W. Ko *et al.*, Phys. Rev. Lett. **121**, 176801 (2018).

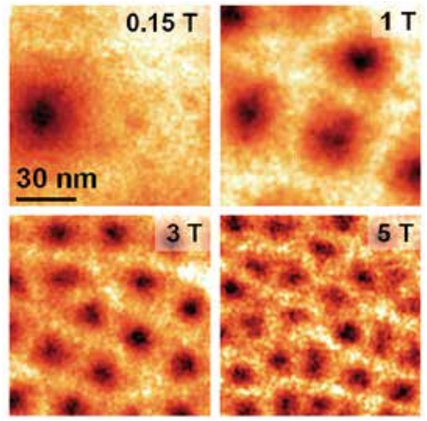
"Tip-Induced local Strain on MoS_2/Graphite Detected by Inelastic Electron Tunneling Spectroscopy"
W. Ko *et al.*, Phys. Rev. B **97**, 125401 (2018).

Ilija Zeljkovic (Boston College)

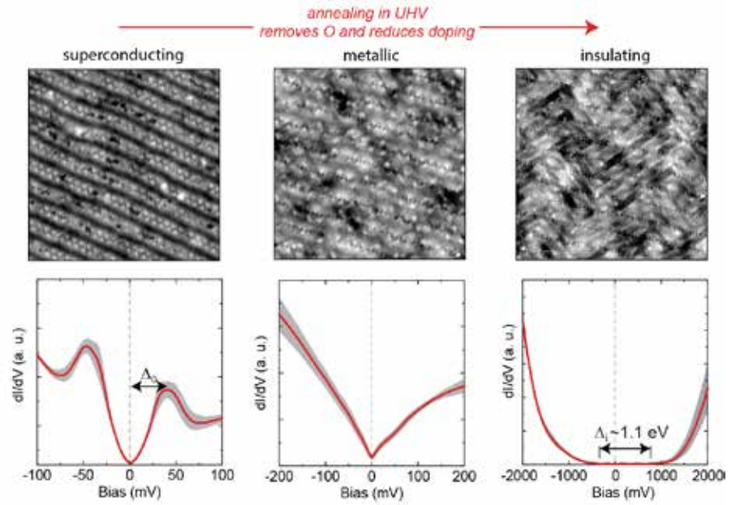
USM1300

Research Interests

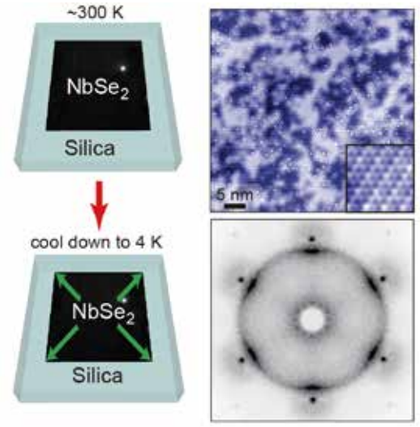
- (Spin-polarized) scanning tunneling microscopy and spectroscopy
- Molecular beam synthesis of thin films and heterostructures
- Strain and magnetic field manipulation of quantum materials
- Unconventional superconductors, topological materials, charge density wave systems, strongly correlated oxides, etc.



dI/dV maps showing a vortex lattice on the surface of proximitized topological insulator Bi_2Te_3 thin film grown on a superconductor Fe(Te,Se) [Zhao *et al.*, **Physical Review B** (2018).]



Imaging the evolution of the electronic structure of high-T_c superconductor $Bi_2Sr_2CaCu_2O_{8+x}$ as a function of in-situ doping. STM topographs (top row) and average *dI/dV* spectra (bottom row) acquired at 4 Kelvin. [Zhao *et al.*, **Nature Materials** (2019).]



Strain manipulation of a charge density wave in NbSe2. STM topograph (top right) and a Fourier transform of a *dI/dV* map showing quasiparticle interference (bottom right) [Gao *et al.*, **PNAS** (2018).]

CoolSpek

"Thermally Activated Delayed Photoluminescence from Pyrenyl-Functionalized CdSe Quantum Dots"
C. Mongin, P. Moroz, M. Zamkov and F. N. Castellano, Nat. Chem. **10**, 225 (2018).

"Photoinduced Self - Assembled Nanostructures and Permanent Polaron Formation in Regioregular Poly(3 - hexylthiophene)"
N. M. B. Neto, M. D. R. Silva, P. T. Araujo, R. N. Sampaio, Adv. Mater. **30,** 1705052 (2018).

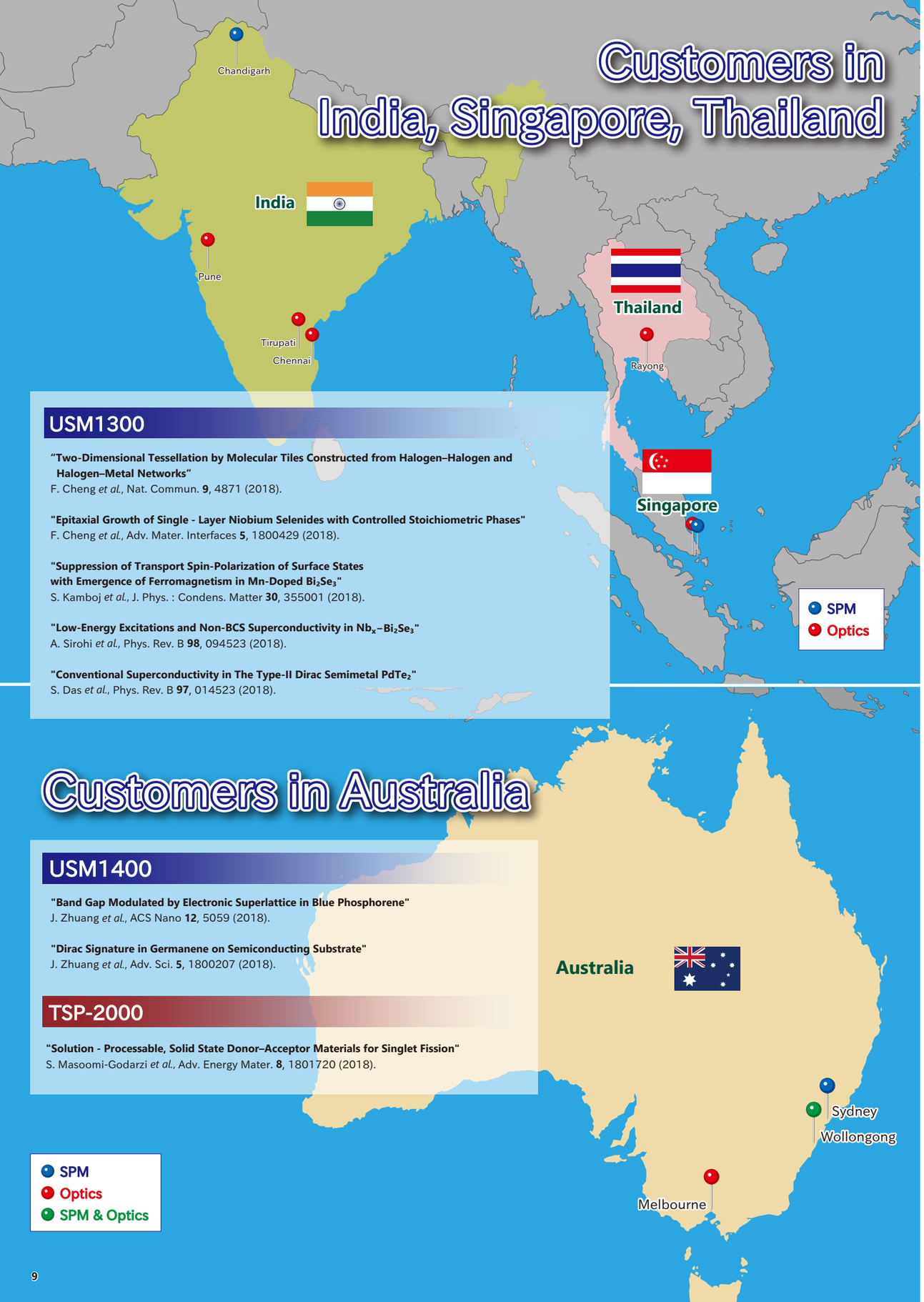
"Spectroscopic and DFT Characterization of a Highly Reactive Nonheme Fe^{V}–Oxo Intermediate"
R. Fan *et al.*, J. Am. Chem. Soc. **140**, 3916 (2018).

"Sc^{3+} (or $HClO_4$) Activation of a Nonheme Fe^{III}–OOH Intermediate for the Rapid Hydroxylation of Cyclohexane and Benzene"
S. Kal, A. Draksharapu, and L. Que, Jr., J. Am. Chem. Soc. **140**, 5798 (2018).

picoTAS

"Excited-State Electronic Properties in Zr-Based Metal-Organic Frameworks as a Function of a Topological Network"
J Yu *et al.*, J. Am. Chem. Soc. **140**, 10488 (2018).

Customers in India, Singapore, Thailand



USM1300

"Two-Dimensional Tessellation by Molecular Tiles Constructed from Halogen–Halogen and Halogen–Metal Networks"
F. Cheng *et al.*, Nat. Commun. **9**, 4871 (2018).

"Epitaxial Growth of Single - Layer Niobium Selenides with Controlled Stoichiometric Phases"
F. Cheng *et al.*, Adv. Mater. Interfaces **5**, 1800429 (2018).

"Suppression of Transport Spin-Polarization of Surface States with Emergence of Ferromagnetism in Mn-Doped Bi_2Se_3"
S. Kamboj *et al.*, J. Phys. : Condens. Matter **30**, 355001 (2018).

"Low-Energy Excitations and Non-BCS Superconductivity in Nb_x–Bi_2Se_3"
A. Sirohi *et al.*, Phys. Rev. B **98**, 094523 (2018).

"Conventional Superconductivity in The Type-II Dirac Semimetal $PdTe_2$"
S. Das *et al.*, Phys. Rev. B **97**, 014523 (2018).

Customers in Australia

USM1400

"Band Gap Modulated by Electronic Superlattice in Blue Phosphorene"
J. Zhuang *et al.*, ACS Nano **12**, 5059 (2018).

"Dirac Signature in Germanene on Semiconducting Substrate"
J. Zhuang *et al.*, Adv. Sci. **5**, 1800207 (2018).

TSP-2000

"Solution - Processable, Solid State Donor–Acceptor Materials for Singlet Fission"
S. Masoomi-Godarzi *et al.*, Adv. Energy Mater. **8**, 1801720 (2018).

Customers in Japan

Publication List (Selected)

USM1200

"Bottom-Up Design of Nitrogen-Containing Carbon Catalysts for the Oxygen Reduction Reaction"
R. Shibuya, T. Kondo, J. Nakamura, Chem. Cat. Chem. **10**, 2019 (2018).

USM1300

"Two Distinct Superconducting Pairing States Divided by The Nematic End Point in $FeSe_{1-x}S_x$"
T. Hanaguri *et al.*, Sci. Adv. **4**, eaar6419 (2018).

"Two Distinct Surface Terminations of $SrVO_3$ (001) Ultrathin Films as an Influential Factor on Metallicity"
H. Oka *et al.*, Appl. Phys. Lett. **113**, 171601 (2018).

USM1400

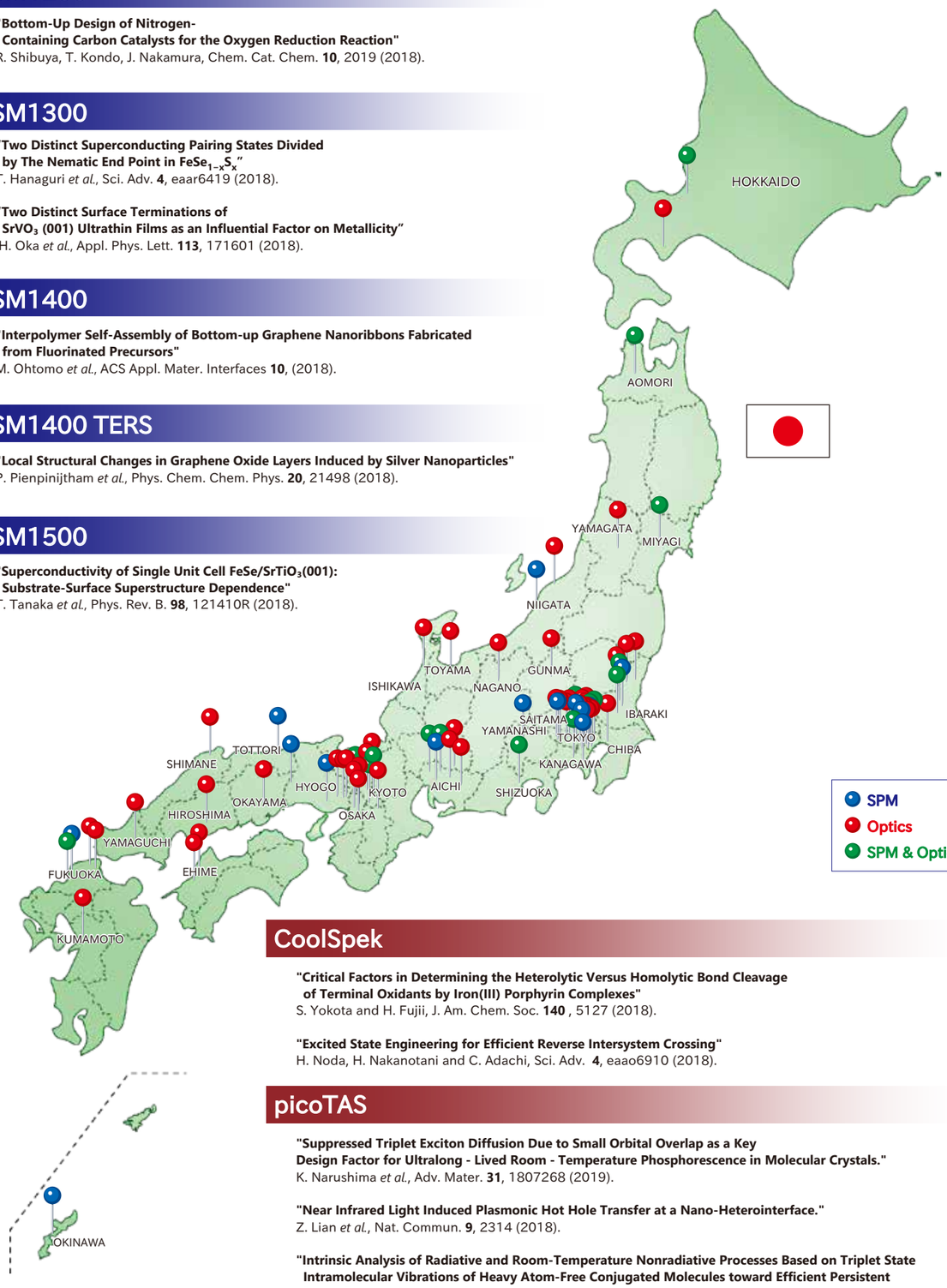
"Interpolymer Self-Assembly of Bottom-up Graphene Nanoribbons Fabricated from Fluorinated Precursors"
M. Ohtomo *et al.*, ACS Appl. Mater. Interfaces **10**, (2018).

USM1400 TERS

"Local Structural Changes in Graphene Oxide Layers Induced by Silver Nanoparticles"
P. Pienpinijtham *et al.*, Phys. Chem. Chem. Phys. **20**, 21498 (2018).

USM1500

"Superconductivity of Single Unit Cell FeSe/$SrTiO_3$(001): Substrate-Surface Superstructure Dependence"
T. Tanaka *et al.*, Phys. Rev. B. **98**, 121410R (2018).



CoolSpek

"Critical Factors in Determining the Heterolytic Versus Homolytic Bond Cleavage of Terminal Oxidants by Iron(III) Porphyrin Complexes"
S. Yokota and H. Fujii, J. Am. Chem. Soc. **140** , 5127 (2018).

"Excited State Engineering for Efficient Reverse Intersystem Crossing"
H. Noda, H. Nakanotani and C. Adachi, Sci. Adv. **4**, eaao6910 (2018).

picoTAS

"Suppressed Triplet Exciton Diffusion Due to Small Orbital Overlap as a Key Design Factor for Ultralong - Lived Room - Temperature Phosphorescence in Molecular Crystals."
K. Narushima *et al.*, Adv. Mater. **31**, 1807268 (2019).

"Near Infrared Light Induced Plasmonic Hot Hole Transfer at a Nano-Heterointerface."
Z. Lian *et al.*, Nat. Commun. **9**, 2314 (2018).

"Intrinsic Analysis of Radiative and Room-Temperature Nonradiative Processes Based on Triplet State Intramolecular Vibrations of Heavy Atom-Free Conjugated Molecules toward Efficient Persistent Room-Temperature Phosphorescence"
S. Hirata, J. Phys. Chem. Lett. **9**, 4251 (2018).

Publication Stats in 2018

- Total number of publications using UNISOKU systems in 2018*=247**
- Total impact factors ~1266
  ~30 papers in Nature.
- Impact factor per employee ~26
  ~Impact factor of Nature Chemistry

The detailed information about the publication list is available on our website.

* Based on searching "UNISOKU" in Google Scholar
** including preprints and PhD theses

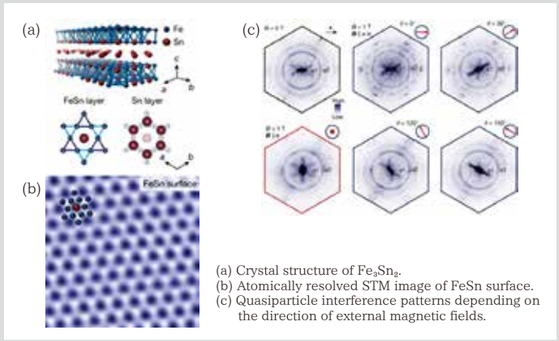
SPM Research Fields

	Num. of Publications	Average Impact factor
Molecules	24	5.17
Transition Metal Dichalcogenides	19	7.02
Graphene	16	6.75
Topological Materials	14	13.75
Fe-based Superconductors	8	9.18
Other Superconductors	7	5.85
Monatomic Films	7	8.87
Oxides	6	4.69
Instrumentation	3	1.43
Miscellaneous	7	3.98
Total	**111**	**6.67**

Giant and Anisotropic Many-Body Spin–Orbit Tunability in a Strongly Correlated Kagome Magnet

Citation: Nature **562**, 91 (2018).
Product Used : USM1300

Yin *et al.* (Hasan group, Princeton University) reported unprecedented giant and anisotropic tuning of electronic states in a kagome ferromagnet Fe_3Sn_2 using a combination of superconducting vector magnets and low temperature STM. The geometry of kagome lattices (lattices consisting of corner sharing triangles) is known to exhibit intriguing phenomena associated with frustrated, correlated and topological electronic states. This situation becomes more entangled in the presence of strong spin-orbit coupling as expected in Fe_3Sn_2 and has remained unexplored. They discovered that quasiparticle interference patterns unambiguously change depending on the direction of external magnetic fields. This result indicates that vector magnetization is capable of altering the many-body electronic states, which cannot be explained by conventional Zeeman physics and thus leads to the realization of a correlated magnetic topological phase, and also offers a new way of exploring emergent phenomena in topological quantum materials.



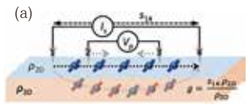
(a) Crystal structure of Fe_3Sn_2.
(b) Atomically resolved STM image of FeSn surface.
(c) Quasiparticle interference patterns depending on the direction of external magnetic fields.

Figures Courtesy of Prof. Hasan（Princeton University）

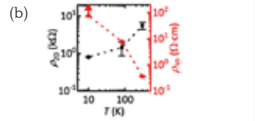
Accessing the Intrinsic Spin Transport in a Topological Insulator by Controlling the Crossover of Bulk-to-Surface Conductance

Citation: Phys. Rev. Lett. **121**, 176801 (2018).
Product Used : USM1400-4P

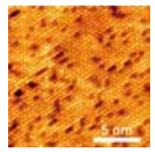
Ko *et al.* (An-Ping Li group, Oak Ridge National Laboratory) performed *in-situ* transport measurements with a four-probe STM to investigate the intrinsic surface state of a bulk-insulating topological insulator Bi_2Te_2Se. The bulk and surface conductivity was separately obtained by measuring four-probe resistance with variable probe spacing and temperature. The spin polarization of carriers was also successfully detected by utilizing a ferromagnetic probe. The observed transport properties of topological surface states showed a carrier mobility of 61000 cm^2/Vs, the highest reported so far, and current-induced spin polarization of 72 %, indicating nearly scattering-free transport as expected from the theory. These results suggest that the combination of multiprobe technique and STM is a powerful tool to study topological transport phenomena and could be further extended to advanced measurements such as nanoscale conductance mapping.



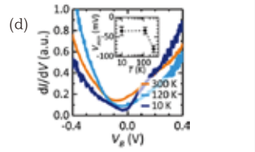
Schematics of electron transport through bulk and surface in a topological insulator and four-probe transport measurements.



Surface and bulk resistivity of Bi_2Te_2Se as a function of temperature.



STM image of Bi_2Te_2Se.



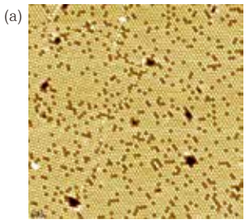
dI/dV spectra taken at various temperature.

Figures Courtesy of Prof. An-Ping Li (Oak Ridge National Laboratory)

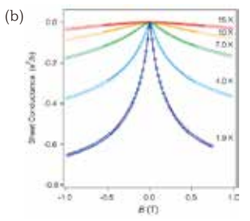
Weak Antilocalization at the Atomic-Scale Limit of Metal Film Thickness

Citation: Nano Lett. **19**, 570 (2019).
Product Used : USM1500

Matetskiy *et al.* (Saranin group, Russian Academy of Sciences) investigated transport and magnetotransport properties of the two-dimensional (2D) Au-Tl compound on Si(111) surface at low temperatures down to 2 K using the four-probe (4P) STM equipped with a superconducting magnet (up to 8 T).
Reducing the dimensionality of the system is known to be accompanied by the emergence of various exotic electronic properties, and the *in-situ* measurement combining STM and 4P techniques could play a crucial role to study such low dimensional phenomena. In this letter, the authors discovered that the atomic-layers-thick Au-Tl surface forms nearly free 2D electron gas system and a weak antilocalization due to strong spin-orbit coupling (SOC) is realized. Since there are many other possible atomic-layer metal films on silicon possessing different strength of SOC and spin textures, this study opens a wide range of opportunities to study low dimensional physics at the atomic-scale limit.



STM image of (Tl, Au)/Si(111).



Temperature dependent magnetoconductivity of (Tl, Au) compound in magnetic fields.

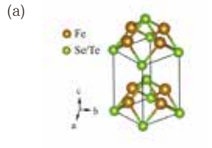
Figures Courtesy of Prof. Saranin (Russian Academy of Sciences)

Thank You For Using UNISOKU Products!

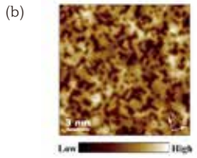
Evidence for Majorana Bound States in an Iron-Based Superconductor

Citation: Science **362**, 333 (2018).
Product Used : USM1300

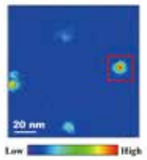
Wang *et al.* (Gao group, Chinese Academy of Sciences) performed low temperature STM measurements (T = 0.55 K) on the iron based superconductor $FeTe_{0.55}Se_{0.45}$ (T_C = 14.5 K), a candidate material to realize topological superconductivity. They observed a sharp zero bias peak in a vortex core that does not split when moving away from the core, which is one of characteristic features of Majorana bound states (MBSs). In addition, the evolution of the zero bias peak as a function of magnetic field, temperature, and tunneling barrier are comprehensively investigated and can be reasonably explained in terms of MBS rather than conventional quasiparticle bound states. Based on these results, they claim these are clear experimental evidence for MBS in this iron superconductor and offer possibilities of realizing and manipulating MBS at relatively high temperatures.



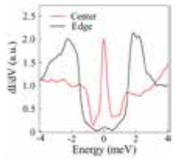
Crystal structure of $FeTe_{0.55}Se_{0.45}$.



STM image of $FeTe_{0.55}Se_{0.45}$.



Zero-bias conductance map measured at a magnetic field of 0.5 T.



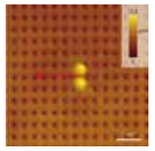
dI/dV spectrum at the center and the edge of a vortex core, respectively.

Figures Courtesy of Prof. Gao（Chinese Academy of Sciences）

Sign Reversal of the Order Parameter in $(Li_{1-x}Fe_x)OHFe_{1-y}Zn_ySe$

Citation: Nat. Phys. **14**, 134 (2018).
Product Used : USM1300

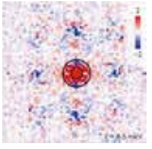
Du *et al.* (Hai-Hu Wen group, Nanjing University) performed quasiparticle interference (QPI) measurements around a non-magnetic impurity in a LiOH-intercalated iron-based superconductor FeSe to investigate whether the superconducting order parameter changes its sign even without hole pockets. By considering the phase message of the Fourier transformed QPI at positive and negative energies between the two gap values, they discovered a clear signature of the sign change of the order parameter in this material. Since the absence of hole pockets are common in other Fe-based superconductors such as intercalated and monolayer FeSe-based systems that exhibit superconductivity at high temperatures of the order of 40K, this result suggests unifying understandings of pairing mechanism of Fe-based superconductors.



STM image of $(Li_{1-x}Fe_x)OHFe_{1-y}Zn_ySe$ around a non-magnetic single impurity.

Typical *dI/dV* map measured at the smaller superconducting gap energy around the single impurity.

Fourier-transformed (FT) QPI image of (b).



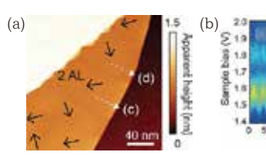
Difference of the FT-QPI images at E = 8.5 meV and -8.5 meV.

Figures Courtesy of Prof. Hai-Hu Wen（Nanjing University）

Enhanced Spontaneous Polarization in Ultrathin SnTe Films with Layered Antipolar Structure

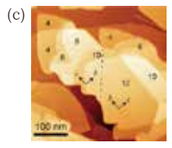
Citation: Adv. Mater. **31**,1804428 (2019).
Product Used : USM1600

Chang *et al.* (Xue group, Tsinghua University) and co-researchers (Parkin group, Max-Planck Institute) performed variable temperature STM to study the structure and polarization of a few layer SnTe films over a wide range of temperature. The enhancement of the ferroelectric transition temperature in 2 atomic layer (AL) SnTe films (T_C~270 K, significantly higher than ~100 K in bulk) was previously found by this group but the underlying mechanism remained unclear. In this paper, they discovered the formation of γ -SnTe, which does not exist in bulk SnTe, is responsible for the enhanced T_C, and the films thicker than 4 AL exhibit even higher T_C over 400 K. These results provide possibilities of atomically-thin γ -SnTe films for developing novel polarization-based devices and will initiate further studies on related two-dimensional ferroelectric materials.

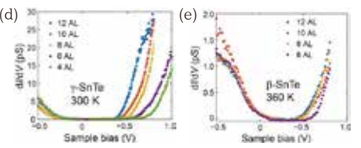


STM image of 2AL γ -SnTe film.

Spatially resolved *dI/dV* spectra measured along the dashed arrows in (a).



STM image of γ -SnTe film at 300 K. The thickness ranges from 4 AL to 12 AL.



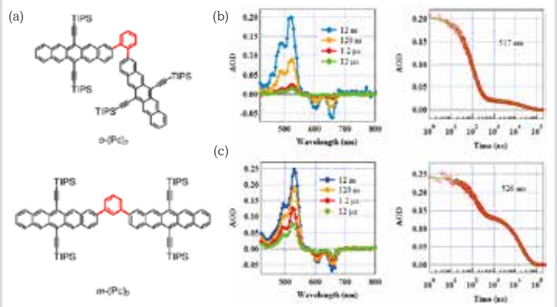
(d,e) *dI/dV* spectra taken on the terraces in (d) γ -SnTe phase at 300 K and (e) β -SnTe phase at 360 K.

Figures Courtesy of Prof. Xue (Tsinghua University)

Multiexciton Dynamics Depending on Intramolecular Orientations in Pentacene Dimers: Recombination and Dissociation of Correlated Triplet Pairs

Citation: J. Phys. Chem. Lett. **9**, 3354 (2018).
Products used: picoTAS, TSP-2000

Singlet fission (SF), the ultrafast splitting process of a singlet exciton into two triplet excitons, has been extensively studied for improving the solar energy conversion properties (e.g., photovoltaics). In this Letter, Sakai *et al.* (Hasobe group, Keio University) synthesized pentacene dimers bridged by a phenylene at ortho and meta positions, and investigated intramolecular orientation-dependent multiexciton dynamics using transient absorption (TA) and time-resolved electron spin resonance. In particular, they succeeded in observing seamless TA signals from femtosecond to millisecond by using the RIPT method in addition to classical techniques, and discovered a significant intramolecular orientation-dependent SF. The rate constants and quantum yields associated with these multiexciton dynamics in the pentacene dimers are quantitatively evaluated. The manifestation of the orientation-dependent multiexciton dynamics revealed in this study provides a new perspective for construction of future optoelectronic and energy conversion devices.



(a) Chemical structures of pentacene (Pc) dimers at (top) ortho, (bottom) meta positions.
(b,c) Nanosecond TA spectra (left) and corresponding time profiles (right) of (b) ortho-$(Pc)_2$ and (c) meta-$(Pc)_2$.

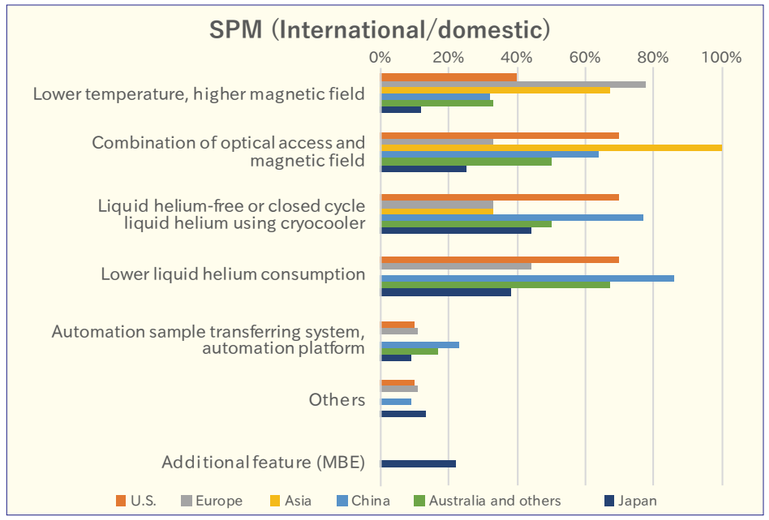
Figures Courtesy of Prof. Taku Hasobe (Keio University)

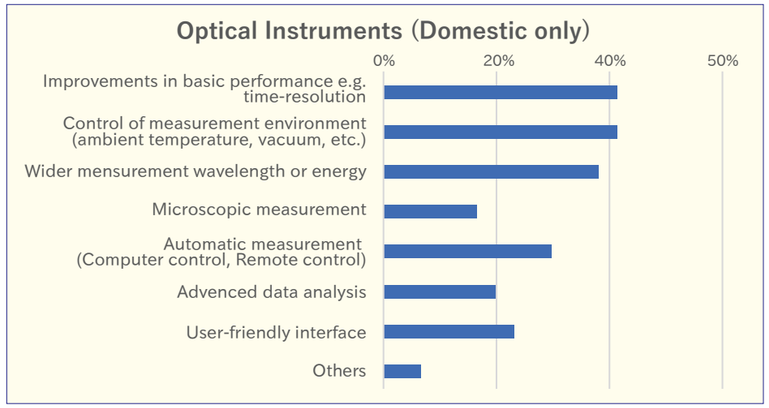
Customer Survey

お客様アンケート

UNISOKU conducted a customer survey in 2018. Requests from customers for the future direction of instrumental developments are summarized in the figures. We will seriously consider this result and make efforts to satisfy those requests by improving our systems and service.

ユニソクは 2018 年に国内と海外のユーザーを対象にアンケートを実施致しました。今後の製品開発として期待するところについての質問では以下のような集計結果となりました。頂いた回答は製品や、地域ごとに分析し、製品やサービスの質をより顧客に満足して頂けるものとなるよう、改善に努めて参ります。

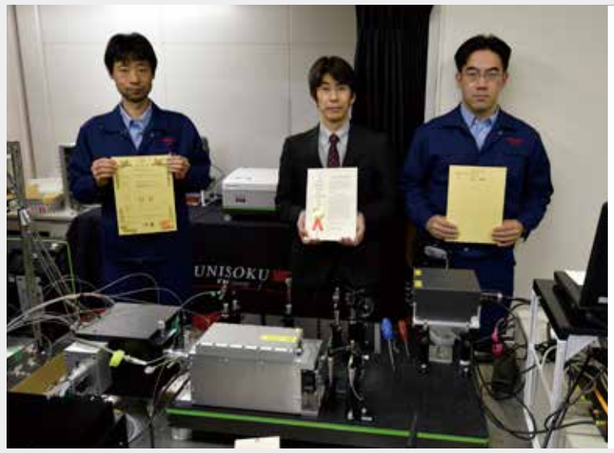




独自特許 RIPT 法で日本発明振興協会・発明功労賞 受賞

Japan Innovation Prize Awarded for RIPT method, a patent developed by UNISOKU

44th Invention Award sponsored by The Japan Society for Advancement of Inventions/The Nikkan Kogyo Shimbun



picoTAS based on the RIPT method

第44回

発明大賞

日本発明振興協会（東京都港区、原昭邦会長、03・3434・6091）と日刊工業新聞社共催の「第44回（2018年度）発明大賞」に26件の発明が選ばれた。発明大賞は発明考案を通して産業の発展や国民生活の向上に寄与した資本金10億円以下の中堅・中小企業や個人、グループに贈られる。表彰式は13日に東京都港区の明治記念館で開く。

受賞製品・技術のポイント

■見えなかったすきま時間の化学反応が見える高速分光技術＝ユニソク（分光・制御事業部取締役部長・中川達氏ほか2人）

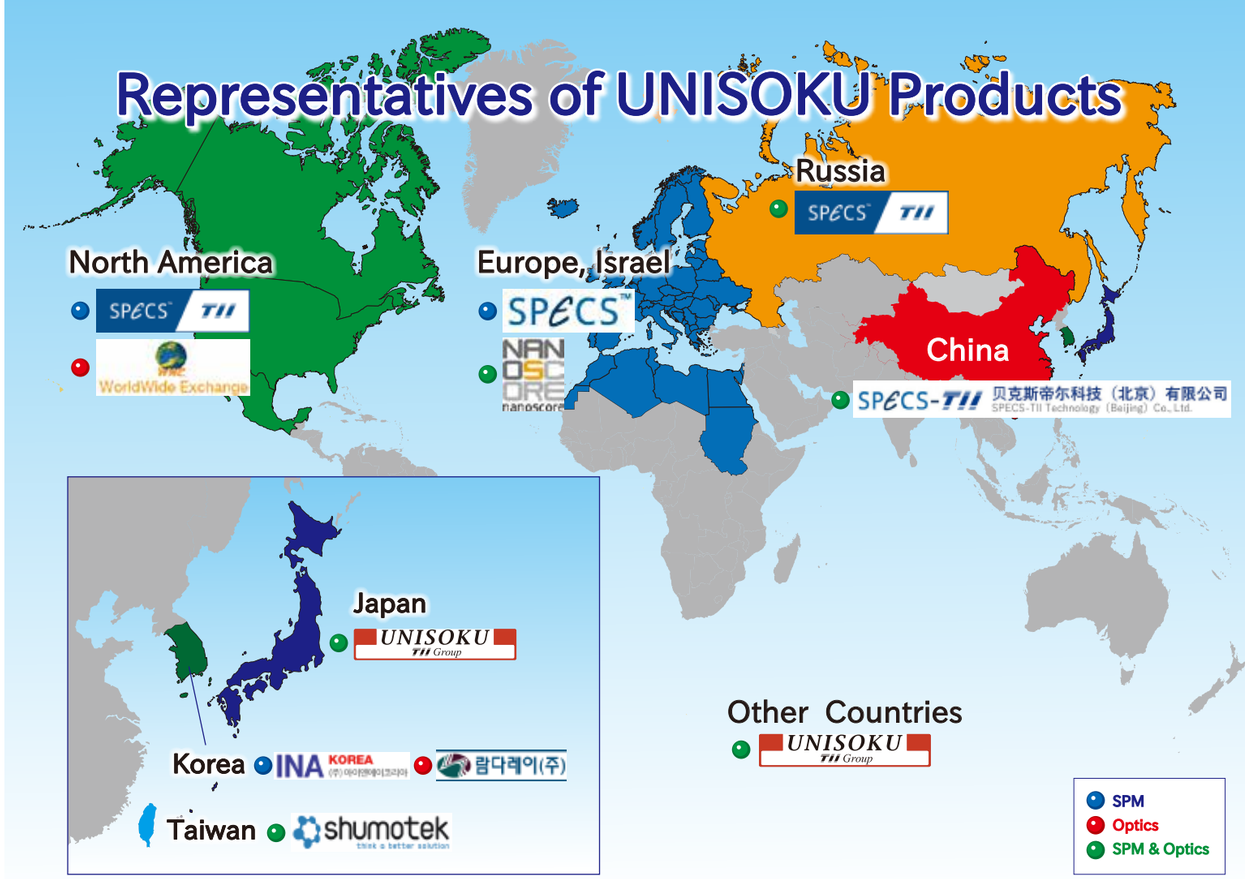
今まで見えなかった時間領域での化学反応が可視化する高速分光技術。2種類の光を利用し、異なるタイミングで光照射と検出をくり返す。データ取得後、絶対値を組み合わせることで時間的に連続なデータを作成。これまで困難だった100ピコ秒レベル（ピコは1兆分の1）の超高分解能でミリ秒レベルの測定時間の計測を可能にした。

材料開発や化学反応の仕組みの解明に役立つため、太陽電池や発光デバイス、触媒などの研究の加速が期待される。（ユニソク＝大阪府枚方市、072・855・6356）

2019 年 3 月 7 日付 掲載

（発明大賞・本賞１件、各賞３件、発明功労賞７件、考案功労賞９件、発明奨励賞５件、発明育成賞１件）

Representatives of UNISOKU Products

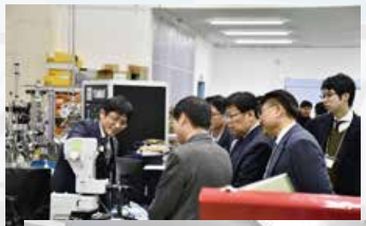


UNISOKU 1st Sales Meeting

第一回代理店会議開催

In Jan., 2019, the 1st Sales Meeting was held at UNISOKU by inviting 18 distributors around the world. It has become a great opportunity to strengthen the connection between UNISOKU and the distributors and also among them by exchanging local market information and directly providing them with the detailed information about systems from UNISOKU.

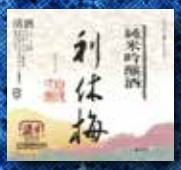
2019 年 1 月の 3 日間で 18 名の全世界の代理店をユニソクに集め第一回代理店会議を開催しました。各担当のマーケットの特徴、ユニソクからシステムの情報を直接提供するなど、より一層代理店との繋がり、また代理店同士の繋がりを強める機会となりました。



日本酒

Sake

Sake Breweries in Osaka



A
大門酒造 株式会社
「利休梅」
DAIMON SHUZO
“RIKYUBAI”

B
有限会社 北庄司酒造店
「荘の郷」
KITASHOJI SHUZOTEN
“SHONOSATO”

C
壽酒造 株式会社
「國乃長」
KOTOBUKI SHUZO
“KUNINOCHO”

D
浪花酒造 有限会社
「浪花正宗」
NANIWA SHUZO
“NANIWA MASAMUNE”

E
西條 合資会社
「天野酒」
SAIJO
“AMANOSAKE”

F
藤本雅一酒造醸
「松花鶴」
FUJIMOTO SHUZO
“SYOKAZURU”

G
寺田酒造 有限会社
「元朝」
TERADA SHUZO
“GANCYOU”

H
山野酒造 株式会社
「片野桜」
YAMANO SHUZO
“KATANOSAKURA”

I
高島酒造 有限会社
「寿盃」
TAKASHIMA SHUZO
“JYUHAI”

J
清鶴酒造 株式会社
「清鶴」
KIYOTSURU SHUZO
“KIYOTSURU”

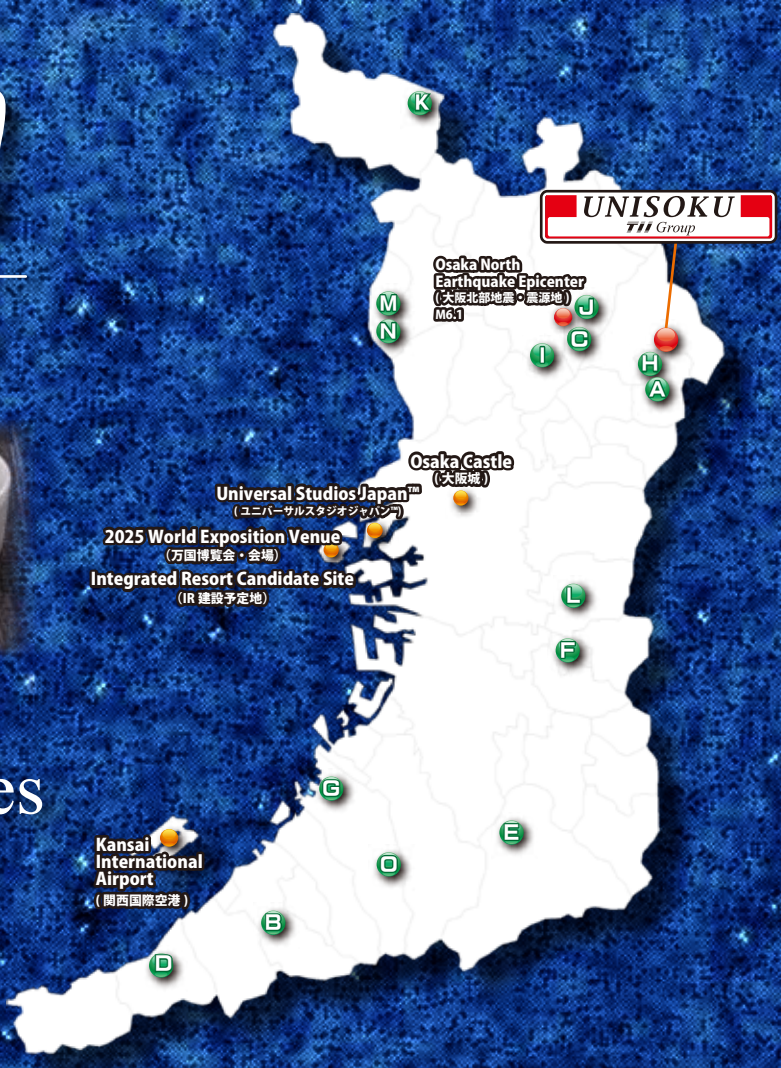
K
秋鹿酒造 有限会社
「秋鹿」
AKISHIKA SHUZO
“AKISHIKA”

L
長龍酒造 株式会社
「長龍」
CHORYO SHUZO
“CHORYO”

M
呉春 株式会社
「呉春」
GOSYUN
“GOSYUN”

N
吉田酒造 株式会社
「緑一」
YOSHIDA SHUZO
“MIDORIICHI”

O
井坂酒造場
「三輪福」
ISAKA SHUZOJYOU
“MIWAFUKU”



UNISOKU Co., Ltd.
UNISOKU TII Group
E-mail: info@unisoku.co.jp Web site: http://www.unisoku.com/
2-4-3 Kasugano, Hirakata, Osaka 573-0131 Japan TEL +81-72(858)6456 FAX +81-72(859)5655

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