FIRST-QS^{2}C WS on "Emergent Phenomena of Correlated Materials"

Shinagawa, Japan, November 13-16, 2013

	Nov. 13 (Wed)	Nov. 14 (Thu)	Nov. 15 (Fri)	Nov. 16 (Sat)
9:00	Registration	Registration	Registration	Registration
9:30				
10:00	Opening	Topological Phonemona I (Chair: Nagaosa/Tatara): Qi-Kun Xue	Interface (Chair: Iwasa/Hwang): J.-M. Triscone	Quantum Beam and Bulk Materials (Chair: Arita/Taguchi): B. Keimer
10:30	Spintronics I (Chair: Kawasaki): S. S. P. Parkin	N. P. Ong	M. Kawasaki	T. Kimura
11:00	A. H. MacDonald	Break 20	H. Y. Hwang	Break 20
11:30	Break 20	H. Fukuyama	Break 20	Y. Ando
12:00	Y. Tokura	N. Kawakami	A. Morpurgo	S. Horiuchi
12:30	N. Nagaosa	M. S. Bahramy	Y. Iwasa	F. Kagawa
13:00	Lunch Break	Lunch Break	T. Hasegawa	Y. Murakami
13:30			Lunch Break	T. Arima
14:00	Spintronics II (Chair: Yunoki): S. Maekawa	Poster Session	Photonics and Multiferroics (Chair: Hasegawa/Arima): T. Rasing	Closing
14:30	G. Tatara		A. Loidl	
15:00	Y. Motome		Y. Takahashi	
15:30	Break 20	Break 10	N. Ogawa	
16:00	Superconductor (Chair: Furusaki): Z.-X. Shen	Topological Phonemona II (Chair: Kawakami): C. Pfleiderer	F. Nori	
16:30	Y. Kitaoka	X. Z.Yu	Break 20	
17:00	R. Arita	S. Ishiwata	N. Spaldin	
17:30	S. Shin	A. Furusaki	M. Gonokami	
18:00	T. Hanaguri	S. Yunoki	Y. Taguchi	
18:30	Break 20	Y. Maeno	S. Seki	
19:00	(Chair: Hanaguri): Selected Poster Previews	Break 10	M. Bibes	
19:30		Banquet		
20:00				
20:30				

Day 1: Wednesday, Nov. 13

10:00 - 10:10 **Opening**

10:10 - 12:20 **[Spintronics I]** Chair: Kawasaki

W01 **Stuart S.P. Parkin** (IBM Almaden Research Center) *30min+5min*
Giant reversible structural changes in epitaxial films of VO_2 induced by ionic liquid gating

W02 **Allan H. MacDonald** (University of Texas) *30min+5min*
Anomalous hall effect revisited

11:20 - 11:40 *Coffee Break*

W03 **Yoshinori Tokura** (RIKEN CEMS) *15min+5min*
3D topological magnets

W04 **Naoto Nagaosa** (RIKEN CEMS) *15min+5min*
Theory of skyrmion dynamics

12:20 - 14:00 *Lunch Break*

14:00 - 15:10 **[Spintronics II]** Chair: Yunoki

W05 **Sadamichi Maekawa** (JAEA) *30min+5min*
Spin current generation and manipulation

W06 **Gen Tatara** (RIKEN CEMS) *15min+5min*
Emergent spin electromagnetism induced by magnetization textures in the presence of spin-orbit interaction

W07 **Yukitoshi Motome** (University of Tokyo) *12min+3min*
Breathing-type bond order and spin Hall effect in itinerant spin ice

15:10 - 15:30 *Coffee Break*

15:30 - 17:40 **[Superconductor]** Chair: Furusaki

W08 **Zhi-Xun Shen** (Stanford University) *30min+5min*
Recent ARPES results from cuprates and FeSe/STO systems

W09 **Yoshio Kitaoka** (Osaka University) *30min+5min*
Recent topics on high-T_c superconductivity in pnictides and cuprates

W10 **Ryotaro Arita** (University of Tokyo) *15min+5min*
Superconducting density functional theory for doped band insulator

W11 **Shik Shin** (ISSP, University of Tokyo) *15min+5min*
Study on ion-pnictide and heavy fermion superconductors by laser ARPES

W12 **Tetsuo Hanaguri** (RIKEN CEMS) *15min+5min*
Superconductivity and orbital physics in FeSe

17:40 - 18:00 *Coffee Break*

Day 1: Wednesday, Nov. 13

18:00 - 19:00 **[Selected Poster Previews]** Chair: Hanaguri

P08 **Hiroki Wadati** (University of Tokyo)
Coexistence of multiple magnetic orderings in $SrCo_6O_{11}$ revealed by resonant soft x-ray scattering

P20 **Sandor Bordacs** (University of Tokyo)
Landau level spectroscopy of Dirac electrons in a polar semiconductor with giant Rashba spin splitting

P27 **Masao Nakamura** (RIKEN CEMS)
Bidirectional photocurrent generation and induced polar state in heterojunctions of $LaFeO_3$

P32 **Kei S. Takahashi** (RIKEN CEMS)
High mobility two-dimensional electron gas in δ-doped $SrTiO_3$ grown by gas source MBE

P35 **Akihito Sawa** (AIST)
Electrolyte-gated correlated electron oxide transistors

P50 **Yusuke Tokunaga** (RIKEN CEMS)
Magnetic biasing of *P-E* loop in a multiferroic ferrite

P64 **Toru Sakai** (JAEA SPring-8)
Spin nanotubes

P71 **Alexander V. Rozhkov** (ITAE RAS)
Electronic phase separation in doped pnictides

P85 **Wataru Koshibae** (RIKEN CEMS)
Dynamics of quenched chiral magnet - creation and annihilation of skyrmions

P94 **Ryutaro Yoshimi** (University of Tokyo)
Resonant tunneling via Dirac electron states in a topological-insulator / semiconductor junction

P96 **Bohm-Jung Yang** (RIKEN CEMS)
Emergent topological phenomena in thin films of pyrochlore iridates

Day 2: Thursday, Nov. 14

9:40 - 12:20 **[Topological Phonemona I]** Chair: Nagaosa/Tatara

T01 **Qi-kun Xue** (Tsinghua University) *30min+5min*
Quantum anomalous Hall effect in a magnetic topological insulator

T02 **Nai Phuan Ong** (Princeton University) *30min+5min*
Beyond Z2-TRI topological insulators

10:50 - 11:10 *Coffee Break*

T03 **Hidetoshi Fukuyama** (Tokyo University of Science) *30min+5min*
Spin-Hall effect and diamagnetism of Dirac electrons

T04 **Norio Kawakami** (Kyoto University) *15min+5min*
Edge states in correlated topological insulators

T05 **Mohammad S. Bahramy** (University of Tokyo) *12min+3min*
Electrical control of valley spin polarization in WSe_2

12:20 - 14:00 *Lunch Break*

14:00 - 15:50 **[Poster Session]**

15:50 - 16:00 *Break*

16:00 - 18:20 **[Topological Phonemona II]** Chair: Kawakami

T06 **Christian Pfleiderer** (Technische Universität München) *30min+5min*
Emergence, stability and decay of skyrmions in chiral magnets

T07 **Xiuzhen Yu** (RIKEN CEMS) *12min+3min*
Spintronics in topological spin texture

T08 **Shintaro Ishiwata** (University of Tokyo) *12min+3min*
Novel helical spin texture in cubic perovskite $SrFeO_3$

T09 **Akira Furusaki** (RIKEN CEMS) *15min+5min*
Stability of surface states of (weak or crystalline) topological insulators

T10 **Seiji Yunoki** (RIKEN CEMS) *15min+5min*
Novel unconventional superconductivity in J_{eff}=1/2 Mott insulator for Ir oxides

T11 **Yoshiteru Maeno** (Kyoto University) *30min+5min*
Mott transition in Ca_2RuO_4 under non-equilibrium: conditions

18:20 - 18:30 *Break*

18:30 - 20:30 **Banquet**

Day 3: Friday, Nov. 15

9:40 - 12:30 **[Interface]** Chair: Iwasa/Hwang

F01 **Jean-Marc Triscone** (University of Geneva) *30min+5min*
2-dimensional superconductivity at the $LaAlO_3/SrTiO_3$ interface

F02 **Masashi Kawasaki** (University of Tokyo and RIKEN CEMS) *15min+5min*
Even-denominator fractional quantum Hall states in ZnO

F03 **Harold Y. Hwang** (Stanford University and RIKEN CEMS) *15min+5min*
Quantum transport in 2D single and bilayer $SrTiO_3$ heterostructures

10:55 - 11:15 *Coffee Break*

F04 **Alberto Morpurgo** (University of Geneva) *30min+5min*
High-quality multi-terminal suspended devices and even-denominator fractional quantum Hall effect in bilayer graphene

F05 **Yoshihiro Iwasa** (University of Tokyo and RIKEN CEMS) *15min+5min*
Field effect on correlated electron systems

F06 **Tatsuo Hasegawa** (AIST) *15min+5min*
Modulation spectroscopy of interface charge transport in correlated organic semiconductors

12:30 - 14:00 *Lunch Break*

14:00 - 18:40 **[Photonics and Multiferroics]** Chair: Hasegawa/Arima

F07 **Theo Rasing** (Radboud University Nijmegen) *30min+5min*

F08 **Alois Loidl** (Augsburg University) *30min+5min*
Electromagnons

F09 **Youtarou Takahashi** (University of Tokyo) *12min+3min*
Colossal dynamical magnetoelectric effect of electromagnons in multiferroic materials

F10 **Naoki Ogawa** (RIKEN CEMS) *12min+3min*
Spin photocurrent in Rashba semiconductors

F11 **Franco Nori** (RIKEN CEMS) *15min+5min*
(1) Majorana fermions in pinned vortices, and (2) phase separation in systems with imperfect nesting, including pnictides and graphene

16:00 - 16:20 *Coffee Break*

F12 **Nicola Spaldin** (ETH Zürich) *30min+5min*
Monopoles in magnetoelectrics

F13 **Makoto Gonokami** (University of Tokyo) *30min+5min*
Production of ultracold bulk excitons for stabilizing a trapped Bose-Einstein condensate

F14 **Yasujiro Taguchi** (RIKEN CEMS) *15min+5min*
Magnetic control of polarization and lattice structure

F15 **Shinichiro Seki** (RIKEN CEMS) *12min+3min*
Magnetoelectric skyrmions in chiral insulating ferrimagnet Cu_2OSeO_3

F16 **Manuel Bibes** (CNRS) *30min+5min*
Putting a strain on $BiFeO_3$

Day 4: Saturday, Nov. 16

9:40 - 12:50 **[Quantum Beam and Bulk Materials]** Chair: Arita/Taguchi

S01 **Bernhard Keimer** (Max-Planck-Institut) *30min+5min*
Spin and charge order in oxide superlattices

S02 **Tsuyoshi Kimura** (Osaka University) *30min+5min*
Observation of multipole helix-chiral domains by resonant x-ray scattering

10:50 - 11:10 *Coffee Break*

S03 **Yoichi Ando** (University of Osaka) *30min+5min*
Experimental studies of topological insulators and superconductors

S04 **Sachio Horiuchi** (AIST) *12min+3min*
Development of donor-acceptor-type organic ferroelectrics

S05 **Fumitaka Kagawa** (RIKEN CEMS) *12min+3min*
Switchable polarization dependent on multidomain topology in a uniaxial organic ferroelectric

S06 **Youichi Murakami** (KEK) *15min+5min*
Resonant soft x-ray scattering studies in SCE system

S07 **Taka-hisa Arima** (University of Tokyo and RIKEN CEMS) *15min+5min*
X-ray imaging of all-in/all-out magnetic domains in pyrochlore

12:55 - 13:05 **Closing**

Poster Session (Day 2: Nov. 14, 14:00 - 15:50)

P01 **Runze Yu** (Tokyo Institute of Technology)
Pb-Cr charge transfer in $Pb_{1-x}Sr_xCrO_3$ as the origin of volume collapse

P02 **Markus Kriener** (RIKEN CEMS)
Thermoelectric properties of $(W,Ta)_1(Se,Te)_2$

P03 **Hajime Hojo** (Tokyo Institute of Technology)
Enhanced piezoelectricity and stabilization of giant tetragonal phase in $BiFe_xCo_{1-x}O_3$

P04 **Masaki Uchida** (University of Tokyo)
Electronic structure and its temperature evolution in Ba_2IrO_4 thin films as probed by angle-resolved photoemission spectroscopy

P05 **Takafumi Hatano** (RIKEN CEMS)
Control of transport properties in half-doped manganites system

P06 **Daisuke Uematsu** (University of Tokyo)
Effect of trigonal distortion of IrO_6 on 5d states in $Eu_2Ir_2O_7$

P07 **Kensuke Kobayashi** (KEK)
Ferroelectric to antiferroelectric structural phase transition in [H-6,6'-dmbp][Hca]

P08 **Hiroki Wadati** (University of Tokyo)
Coexistence of multiple magnetic orderings in $SrCo_6O_{11}$ revealed by resonant soft x-ray scattering

P09 **Hajime Yamamoto** (Tokyo Institute of Technology)
Weak ferromagnetism in $BiFe_{1-x}Co_xO_3$ induced by the spin structure change

P10 **Takehito Suzuki** (RIKEN CEMS)
Thermoelectric properties of filled $IrSb_3$

P11 **Toshiya Ideue** (University of Tokyo)
Transport properties of polar semiconductor BiTeI under pressure

P12 **Yusuke Serizawa** (Tokyo Metropolitan University)
Electromagnetic response of Rashba systems

P13 **Debraj Choudhury** (RIKEN CEMS)
Enhanced magnetocaloric effect due to strong-coupling between magnetism and structure in $MnCo_{1-x}Zn_xGe$

P14 **Joji Nasu** (University of Tokyo)
Finite-T phase transition to quantum spin liquid in a 3D Kitaev model

P15 **Makoto Naka** (RIKEN CEMS)
Long-period charge fluctuation and charge dynamics in θ-$(BEDT\text{-}TTF)_2X$

P16 **Keisuke Matsuura** (University of Tokyo)
Magnetic excitations in MnV_2O_4 studied by inelastic neutron scattering

P17 **Atsunori Doi** (University of Tokyo)
Insulator-metal transition and spin state fluctuation in $LaCoO_3$

P18 **Nao Minami** (University of Tokyo)
Quantum relaxation dynamics of domain walls in hydrogen-bonded imidazole ferroelectrics

P19 **Koji Ikeura** (University of Tokyo)
Large enhancement of thermopower in semimetallic β-$MoTe_2$ by chemical substitution

P20 **Sandor Bordacs** (University of Tokyo)
Landau level spectroscopy of Dirac electrons in a polar semiconductor with giant Rashba spin splitting

P21 **Satoshi Matsuoka** (AIST)
Band coherence analysis of correlated polymer semiconductors

P22 **Robert Peters** (Kyoto University)
Artificially layered heavy fermion systems

P23 **Masato Ito** (University of Tokyo)
EDL transistor characteristics with $BaTiO_3$ channels

P24 **Tomoki Tambo** (University of Tokyo)
Tuning FQHE in oxide by air-gap gating

P25 **Zhigao Sheng** (RIKEN CEMS)
Magneto-tunable photocurrent in manganite based heterojunctions

P26 **Keisuke Shibuya** (AIST)
Strain effect on the metal-insulator transition temperature in VO_2 thin films

P27 **Masao Nakamura** (RIKEN CEMS)
Bidirectional photocurrent generation and induced polar state in heterojunctions of $LaFeO_3$

P28 **Neeraj Kumar** (AIST)
Photolithography of Parylene-C/Ta_2O_5 hybrid gate insulator for future Mott transistors

P29 **Jobu Matsuno** (RIKEN CEMS)
Tuning of the spin-orbit Mott state by tailoring superlattices

P30 **Joseph Falson** (University of Tokyo)
Even-denominator fractional quantum Hall physics in ZnO

P31 **Atsushi Fukuchi** (AIST)
Ferroelectric resistive switching induced in a dielectric/ferroelectric heterostructure

P32 **Kei S. Takahashi** (RIKEN CEMS)
High mobility two-dimensional electron gas in δ-doped $SrTiO_3$ grown by gas source MBE

P33 **Masaki Nakano** (Tohoku University)
Electric-field induced giant structural/spectral changes in VO_2

P34 **Yuya Matsubara** (University of Tokyo)
Polar metallic state in La-doped $BatiO_3$ film grown by gas source molecular beam epitaxy

P35 **Akihito Sawa** (AIST)
Electrolyte-gated correlated electron oxide transistors

P36 **Takahiro C. Fujita** (University of Tokyo)
Octupole magnetic ordering and magnetotransport properties in $Eu_2Ir_2O_7$ thin films

P37 **Yuhki Kohsaka** (RIKEN CEMS)
Visualizing a p-n junction of two-dimensional electronic gases on a polar semiconductor BiTeI

P38 **Tomoyuki Tsuyama** (University of Tokyo)
X-ray magnetic circular dichroism for ferromagnetic insulator of $BaFeO_3$ thin film

P39 **Qing-Yan Wang** (RIKEN CEMS)
Compressively strained $EuTiO_3$ films grown by gas source MBE

P40 **Denis Maryenko** (RIKEN CEMS)
$Mg_xZn_{1-x}O$/ZnO transport at large tilt angle and in a magnetic field up to 33 Tesla

P41 **Yuki Noda** (AIST)
Inkjet printing of single-crystal organic semiconductors: initial microfluid dynamics in double-shot inkjet technique

P42 **Toshikazu Yamada** (AIST)
Developing innovative printing process for high-resolution metal wiring with nanometal inks

P43 **Sunao Shimizu** (RIKEN CEMS)
Electrically tunable anomalous Hall effect in ultra-thin films of Pt

P44 **Hiromi Minemawari** (AIST)
Inkjet printing of single-crystal organic semiconductors: film growth and field-effect characteristics

P45 **Nobuyuki Abe** (University of Tokyo)
Magnetoelectric effect in $Ca_2Fe_{2-x}Al_xO_5$

P46 **Shingo Toyoda** (University of Tokyo)
Spin-orbital coupled state in CuB_2O_4

P47 **Alexandra Kalashnikova** (Ioffe Institute)
Genuine crystal-field parameters of copper metaborate and related cuprates

P48 **Masahiro Rikiso** (University of Tokyo)
Magneto-optical effect in chiral magnetic insulator Cu_2OSeO_3

P49 **Shunsuke Kibayashi** (University of Tokyo)
Magnetochiral dichroism resonant with electromagnon in a helimagnet

P50 **Yusuke Tokunaga** (RIKEN CEMS)
Magnetic biasing of *P-E* loop in a multiferroic ferrite

P51 **Hideo Kawaguchi** (Tokyo Metropolitan University)
Coupling between spin electromagnetic field and electromagnetic wave

P52 **Yukitoshi Motome** (University of Tokyo)
Toroidal ordering in metals: band shift and magnetotransport

P53 **Takaaki Sudayama** (KEK)
Artificial superlattice Mn thin film with large magneto-resistance studied by resonant soft x-ray scattering under magnetic field

P54 **Khanh D. Nguyen** (Tohoku University)
Magneto-electric effect in non-centrosymmetric $(Cu,Ni)B_2O_4$

P55 **Yuichi Yamasaki** (KEK)
X-ray induced phase transition between multiferroic states in a perovskite manganite

P56 **Yuki Ohuchi** (University of Tokyo)
Photo-induced sign inversion of anomalous Hall effect in EuO thin films

P57 **Neill Lambert** (RIKEN CEMS)
Photon-mediated electron transport in hybrid circuit-QED

P58 **Takuya Satoh** (University of Tokyo)
Optical excitation of spin oscillations in NiO

P59 **Jun'ya Tsutsumi** (AIST)
Photocarrier generation via charge-transfer excitation in correlated polymer semiconductors

P60 **Yurika Kubo** (Waseda University)
Tunable ‘rotons’ in 2D antiferromagnets

P61 **Daisuke Morikawa** (RIKEN CEMS)
Crystal chirality and skyrmion helicity in MnSi and (Fe,Co)Si as determined by transmission electron microscopy

P62 **Aron Beekman** (RIKEN CEMS)
Long-range interactions between skyrmions via magnon exchange

P63 **Yoichi Nii** (RIKEN CEMS)
Elastic properties of MnSi

P64 **Toru Sakai** (JAEA SPring-8)
Spin nanotubes

P65 **Kiyou Shibata** (University of Tokyo)
Size and helicity of skyrmions in helimagnets $Mn_{1-x}Fe_xGe$

P66 **Yuta Sasaki** (Tokyo Metropolitan University)
Electrical control of transmitted spin wave in ferromagnetic metal and insulator junction system

P67 **Nobuhiko Taniguchi** (University of Tsukuba)
Electrically induced spin current in a nonequilibrium spin-orbit nano interferometer

P68 **Henri M. Saarikoski** (RIKEN CEMS)
Control of spin geometric phase in semiconductor quantum rings

P69 **Masashi Kubota** (RIKEN CEMS)
Manipulation of magnetic domain by local stress

P70 **Tomoyuki Yokouchi** (University of Tokyo)
Skrmion stability in thin films of $Mn_{1-x}Fe_xSi$ as investigated by topological Hall effect

P71 **Alexander V. Rozhkov** (ITAE RAS)
Electronic phase separation in doped pnictides

P72 **Seiichiro Suga** (University of Hyogo)
Extended s-wave superfluid in repulsively interacting three-component fermionic atoms in optical lattices

P73 **Sho Nakosai** (University of Tokyo)
p-wave superconducting states with magnetic moments on a conventional *s*-wave superconductor

P74 **Ryosuke Akashi** (University of Tokyo)
Impact of plasmons on superconducting transition temperature in layered nitrides: Ab initio study

P75 **Kosuke Saito** (University of Tokyo)
Fermi level tuning of layered pnictogen chalcogenides by electrochemical Cu-intercalation

P76 **Hiroshi Watanabe** (RIKEN CEMS)
Novel J_{eff}=1/2 insulator and possible superconductivity in Sr_2IrO_4 with large spin-orbit coupling

P77 **Ryo Fukaya** (Tokyo Institute of Technology)
Ultrafast electronic phase control of two-leg ladder cuprate $Sr_{14-x}Ca_xCu_{24}O_{41}$

P78 **Hsiang-Lin Liu** (National Taiwan Normal University)
Lattice dynamics and electron-phonon interactions in $FeSe_{0.35}Te_{0.65}$: Iron isotope effect

P79 **Hiroshi Oike** (RIKEN CEMS)
A doped organic superconductor crossing the Mott boundary

P80 **Hideaki Sakai** (University of Tokyo)
Variation of superconducting properties with electron doping in $SrFBiS_2$

P81 **Giorgos Giavaras** (RIKEN CEMS)
Tunable graphene quantum dots

P82 **Hiroyoshi Nobukane** (Hokkaido University)
Majorana edge transport in Sr_2RuO_4

P83 **Yositake Takane** (Hiroshima University)
Unified description of Dirac electrons on a curved surface of strong topological insulators

P84 **Toshikaze Kariyado** (University of Tsukuba)
Symmetry protected Z_2 Berry phase in massless Dirac fermion systems

P85 **Wataru Koshibae** (RIKEN CEMS)
Dynamics of quenched chiral magnet - creation and annihilation of skyrmions

P86 **Alexander L. Rakhmanov** (ITAE RAS)
Majorana fermions in pinned vortices

P87 **Artem Sboychakov** (ITAE RAS)
Antiferromagnetic states and phase separation in doped AA-stacked graphene bilayers

P88 **Kliment Kugel** (ITAE RAS)
Driven conductance of graphene under effect of strong AC field

P89 **Shimpei Goto** (Waseda University)
Phenomenology for loop-current phases

P90 **Igor Proskurin** (University of Tokyo)
Thermoelectric transport of massless Dirac fermions in magnetic field

P91 **Katsuya Iwaya** (RIKEN CEMS)
STM studies of $GeBi_2Te_4$ and $SnBi_2Te_4$

P92 **Linda Ye** (University of Tokyo)
Transport study of ternary topological insulators $Ge_xSn_{1-x}Bi_2Te_4$

P93 **Yingshuang Fu** (RIKEN CEMS)
Real-space imaging of Dirac-Landau orbits in Bi_2Se_3

P94 **Ryutaro Yoshimi** (University of Tokyo)
Resonant tunneling via Dirac electron states in a topological-insulator / semiconductor junction

P95 **Takahiro Morimoto** (RIKEN)
Classification of topological insulators with reflection symmetries

P96 **Bohm-Jung Yang** (RIKEN CEMS)
Emergent topological phenomena in thin films of pyrochlore iridates

P97 **Suvankar Chakraverty** (RIKEN CEMS)
Topological Hall effect in perovskite oxide thin films and heterostructurs

P98 **Kentaro Ueda** (University of Tokyo)
Anomalous domain-wall conductance in pyrochlore-type $Nd_{2}Ir_2O_7$ on the verge of metal-insulator transition