

Frontiers of Condensed Matter Physics (FCMP) Lectures

With the NSF PIRE (Partnership for International Research and Education) support from 2011-15, Uemura initiated the concept of the Frontiers of Condensed Matter Physics (FCMP) lectures given by leading researchers of CMP and AMO fields. This initiative began first by inviting eminent scientists to give lectures at Columbia University on their topics of expertise, together with interviews of these lecturers by postdoctoral scholars. These lectures and interviews filled a gap that exists between pedagogy and research – pedagogical classes do not explain the process by which research is conducted, while day-to-day research does not always give students the big-picture perspective of the research enterprise. Students found these lectures immensely useful in choosing research directions, interacting with eminent researchers and gaining knowledge on frontier topics at an understandable level. Encouraged by the strong student response, Uemura organized workshops at the conclusion of FCMP lecture series each year, giving students the opportunity for intensive and immersive research experiences and discussions.

After the first couple of years of FCMP lectures at Columbia university, Uemura began to receive requests from other institutions for lecture materials, and conceptualized the simultaneous broadcast (simulcast) of FCMP lectures in classrooms of other universities. In 2013-17, the simulcast classes/activities were organized between Columbia, Rice and U Oregon Eugene. FCMP lectures were given in Paris in the Fall 2017 when Uemura visited Ecole Polytechnique, and simulcasted to Columbia, Rutgers, PSI, and MPI in Hamburg and Dresden. Figure 1 shows an FCMP lecture given in Paris by a French Nobel Laureate Albert Fert. While the FCMP activity has been anchored by Uemura, it has now spread across multiple universities and institutions both nationally and internationally via an informal network. All of the co-PIs have been regular speakers at the lecture series, and have participated in workshops and other events over the years. Since 2011 more than 360 videos of FCMP lectures have been archived in Vimeo and Columbia Coursework sites, and have been made available to motivated students and postdocs upon request. In the Spring 2021-2023 semesters, under Covid-19 restrictions, we have launched a new series of fully online FCMP Zoom lectures, to which total ~ 200 grad students and postdocs have signed up from more than 20 US and foreign institutions.

To promote direct interaction between FCMP lecturers and participating students, FCMP Workshops were held in Beijing (2014), Vancouver (2015), Tokyo (2017) and Frascati (2018), each having 100-200 participants. FCMP activities also invited many leading female / underrepresented minority scientists as lecturers. Among over 600 graduate students who participated in the FCMP activities, ~ 15 % belonged to underrepresented groups. During visits of these researchers, special events such as lunches were organized to encourage undergraduate, graduate students and postdocs to interact with these successful role models and establish contact with them.



Fig. 1: an FCMP lecture given by Albert Fert in Dec. 2017 at Ecole Polytechnique on spintronics in a course organized by Uemura.

After finishing FCMP Courses during 2011 -22, about 20 graduate students from Columbia and other institutions participated in collaborative research at foreign accelerator facilities with FCMP lecturers and obtained results which significantly contributed towards their PhD theses.

Table 1. FCMP activities 2011 - 2022										
FCMP Lecture Courses					Associated Tours and Workshops (WS)					
Semester	location	course#	enroll	format			Destination	days	participants	
2011 Fall	Columbia	G6020	17	live						
	U Tokyo		~ 20	video	2012 March	Tour	Columbia/BNL	10	Tokyo U	7
2012 Sum.	U Tokyo	特別講義	~ 30	live						
2012 Fall	Columbia	G6021	21	video	2013 March	Tour	Tokyo/Kyoto	10-14	Columbia	16
2013 Fall	Columbia	G6022	18	live / simul	2014 March	WS	Beijing IOP	7	Total	200
	Rice		~ 10	simul / live					Columbia	20
	Tsinghua		~ 10	video seminar					Rice	2
	Fudan		~ 10	video seminar					U Tokyo	1
	Zhejiang		~ 10	video seminar					Chinese U	80
2014 Fall	Columbia	G6023	35	live / simul	2015 May	WS	TRIUMF, Canada	7	Total	80
	Rice		15	simul / live			(MuSR hands-on training)		Columbia	23
	CBPF-Rio		1	on-line audit					US Univ.	~ 20
	Harvard		2	on-line audit					Chinese U	6
	McMaster		2	on-line audit					Canada U	10
2015 Fall	Columbia	G6024	33	live / simul	2017 Jan.		JPARC, Tokyo U	5	Total	100
	Rice		~ 10	live / simul		Tour	JPARC Tour		Columbia	13
	U Oregon		7	simul / live		WS	REIMEI WS		US/Canada	6
	CBPF-Rio		~ 5	on-line audit		Symp	Mott Symposium		Chinese U	3
2017 Spring	Columbia	GR6025	33	live / simul						
	Rice			simul / live						
	U Oregon		8	simul / live						
	UC Berkeley		10~20	live / simul						
2017 Fall	CUGC Paris	GR6026	10	live / simul	2018 June	WS	Rome-Frascati	5	Total	120
	Ecole Polytechnique		10	live / simul					Columbia	10
	Columbia	GR6026	20	simul					Tokyo	2
	Rutgers		10	simul					Europe	20
2018 Fall	Columbia	GR6027	30	live / simul						
2019 Fall	Columbia	GR6028	35	live / simul						
					2020 June		virtual WS (QCM2020)	5	Total	70

2021 Spring	Columbia	GR6029	30	online	2021 June	virtual WS (QCM2021)	3	Total	50
	Observers		188	online					
2022 Spring	Columbia	G6020	20	online					
	Observers		69	online					
2023 Spring	Columbia	G6020	16	online					
	Observers		109	online					
2024 Spring	Columbia	G6020	21	online					
	Observers		133	online					

Course Evaluation by enrolled students (5.0 Max)

		Course	Instructor			Course	Instructor
2012 Fall	G6021	4.63	4.53	2018 Fall	GR6027	4.45	4.38
2013 Fall	G6022	4.81	4.81	2019 Fall	GR6028	4.5	4.67
2014 Fall	G6023	4.64	4.64	2021 Spring	GR6029	4.79	4.57
2015 Fall	G6024	4.38	4.38	2022 Spring	GR6020	4.33	4.56
2017 Spring	GR6025	4.86	4.81	2023 Spring	GR6020	4.8	5.0
2017 Fall	GR6026	4.75	N/A				

The 3rd Super-PIRE REIMEI Workshop on Frontiers of Condensed Matter Physics

2014 March, Beijing IOP

The 3rd Super-PIRE REIMEI Workshop on Frontiers of Condensed Matter Physics
(2014.3.17-3.21)



The 3rd Super-PIRE REIMEI Workshop on Frontiers of Condensed Matter Physics
(2014.3.17-3.21)

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4th Super-PIRE - 26th REIMEI Workshop on Frontiers of Condensed Matter Physics

May 16 – 22, 2015

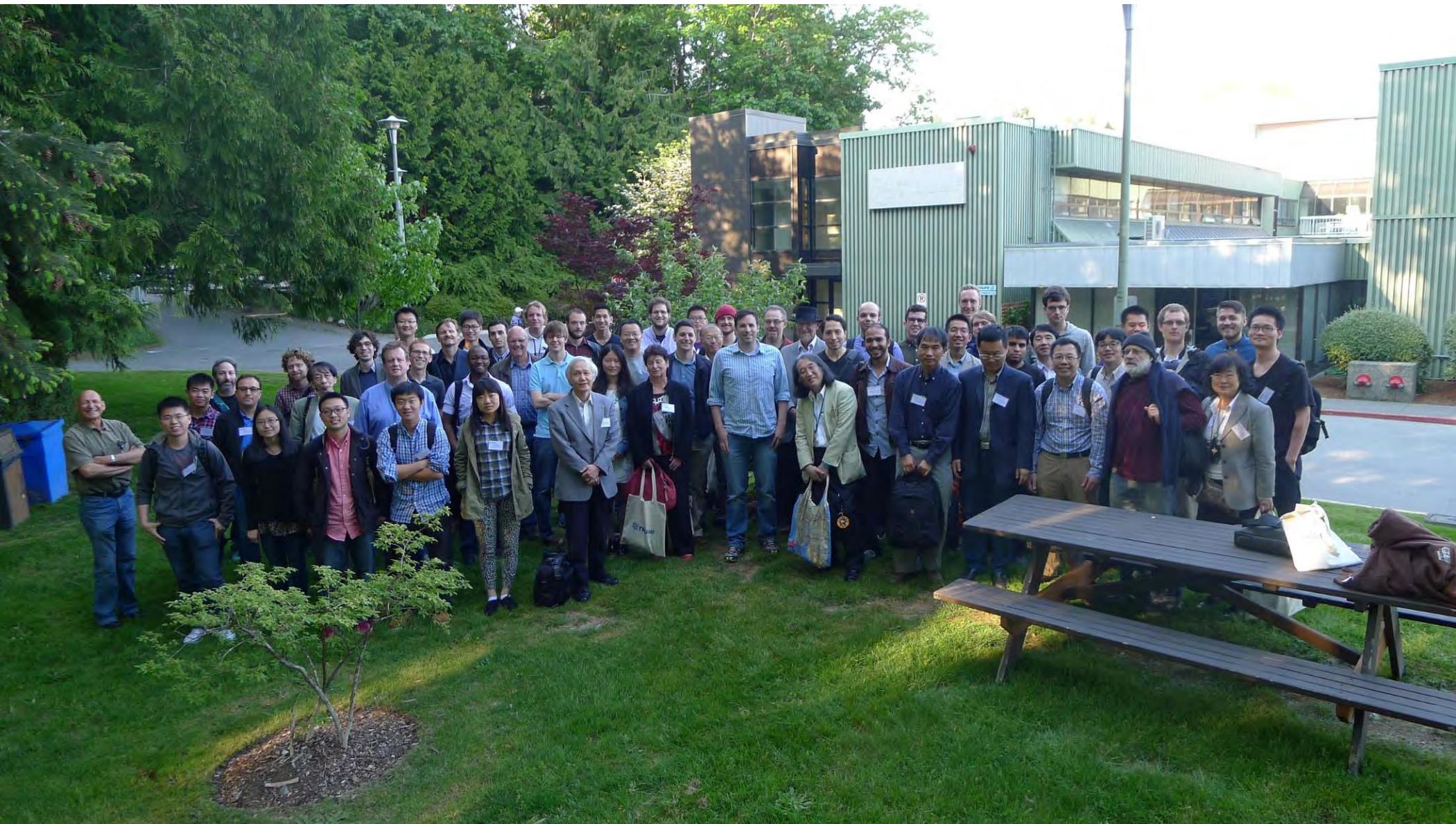
TRIUMF, Vancouver, Canada

Unconventional Superconductors	Neutrons
Quantum Critical Phenomena	Muons
Skymion / Itinerant Magnets	Photons
Ferromagnetic Semiconductors	STM
Mott Transition systems	Theory

Visiting and Local Vancouver Participants: Everybody Welcome

Organizers: Iain McKenzie (TRIUMF) and Tomo Uemura (Columbia)

FCMP Workshop at TRIUMF, Vancouver, May 2015





Hands-on Training

Muon Spin Relaxation Experiments at TRIUMF (Vancouver)

3 days; 2015 May

<i>T</i>	<i>Frandsen</i>	<i>Benjamin</i>	<i>Columbia University</i>
2	Dadgar	Abdollah	Columbia University
2	Jiang	Shan	UCLA
2	Kerelsky	Alexander	Columbia University
2	Notis	Amy	Columbia University
2	Yonezawa	Shingo	Dept. of Phys. Kyoto Uni
2	Tchernyshyov	Oleg	Johns Hopkins Universit

Tutor

Trainees

2017 January FCMP Japan Tour: JPARC neutron + muon + HEP Tour



REIMEI Workshop on correlated electrons and spintronics





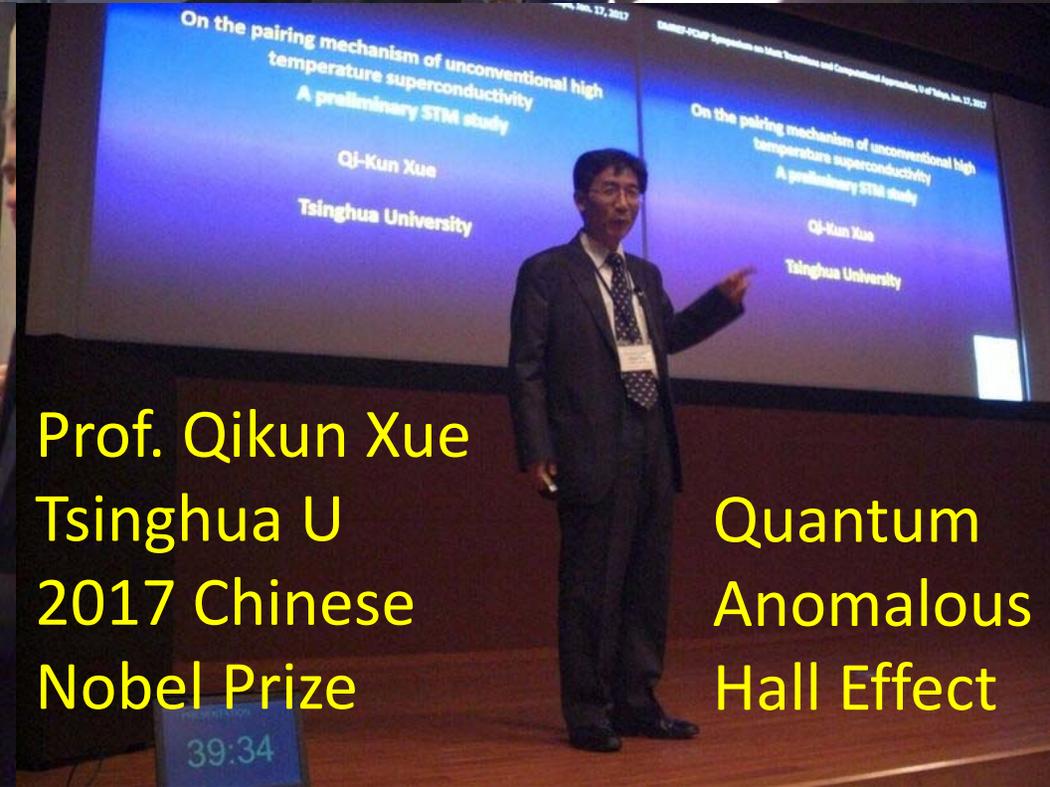
Dinner party for JPARC Tour participants on Jan. 13, 2017

Joined by 22 grad students from the US, Canada and China,
plus 11 grad students from Univ. Tokyo and RIKEN

**FCMP Symposium
on Mott Transitions
2017 Jan 17, Tokyo Univ.**



Ben Frandsen



**Prof. Qikun Xue
Tsinghua U
2017 Chinese
Nobel Prize**

**Quantum
Anomalous
Hall Effect**