International Symposium
on Frontier of Superconductivity Research (VIII)

Advances in Exploration
of Novel Superconductors

Program and Abstracts

October 24-27, 2019

National Lab for Superconductivity

Institute of Physics, Chinese Academy of Sciences

Beijing National Laboratory for Condensed Matter Physics

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Brief Schedule:

Thursday, October 24, 2019
15:00~19:00 Registration at LiaoNing International Hotel
(Registration continues on October 25 near the gate of M234, IOP)

Friday, October 25, 2019
Scientific program

Saturday, October 26, 2019
Scientific program

Sunday, October 27, 2019
Conference excursion

Welcome

The International Symposium on Frontier of Superconductivity Research (VIII) — Advances in Exploration of Novel Superconductors, organized by the National Lab for Superconductivity, will be held on the campus of Institute of Physics, Chinese Academy of Sciences, Beijing, China, between October 24 and 27, 2019.

The National Lab for Superconductivity at the Institute of Physics, Chinese Academy of Sciences, Beijing (http://nlsc.iphy.ac.cn/), established in 1991, is a national premier base for superconductivity research in China and an important hub for academic exchange among domestic and foreign scholars in this field. Current research projects include exploring for new superconductors, investigating the superconductivity mechanism and related physics problems, thin films synthesis as well as superconducting devices development and their applications.

Aiming to strengthen international scientific exchange and foster international scientific collaboration, the National Lab for Superconductivity initiated in 2011 an "International Symposium on Frontier of Superconductivity Research" which contains a series of symposiums held once a year. We have successfully organized the symposiums "Exploration of Novel Superconductors" (2011), ARPES (2012), Neutron Scattering (2013), STM (2014), Transport and Thermodynamic Properties (2015), NMR and μSR (2016) and Optical Spectroscopy (2017) on Unconventional Superconductors. This year marks the 8th symposium that focuses on "Advances in Exploration of Novel Superconductors". Leading experts will provide overview, personal experience, latest results and future perspectives on various novel superconductors, including high temperature cuprate superconductors, iron-based superconductors, heavy Fermion superconductors, carbon-based and super-hydride superconductors, and more.

We hope to make the Symposium informative, encouraging and inspiring, particularly to young scientists and graduate students.

Chair: Prof. Xingjiang ZHOU,
Director
National Lab for Superconductivity

Xingjiang Zhou

Co-Chair: Prof. Kui JIN
Deputy Director
National Lab for Superconductivity

Kui Jin

Beijing, China, October 2019

Scientific Program

(Each presentation includes 45 minutes talk plus 5 minutes Q&A)

October 25, 2019, Friday, M234, IOP

Morning Session			
Chair: Prof. Kui Jin			
08:30- 08:40	Xingjiang Zhou	Institute of Physics, Beijing	Welcome Speech and Brief Introduction to the National Lab for Superconductivity and the Symposium
08:40- 09:30	Paul C. W. Chu	University of Houston	Superconductivity at Above the Maximum Temperature Predicted by the Universal Relation
09:30 - 10:20	Yanwei Ma	Institute of Electrical Engineering, CAS	Recent Advances of Iron-Based Wires and Tapes for High-Field Applications
10:20 - 10:40 Break & Group Photo			
Chair: Prof. Yanming Ma			
10:40 - 11:30	Xiaoli Dong	Institute of Physics, Beijing	Recent Progresses in Syntheses and Physical Properties of FeSe-Based Single Crystals and Films
11:30 - 12:20	Tao Xiang	Institute of Physics, Beijing	High-Tc Superconductivity by Metallizing Strong-Bonding Electrons
12:20 - 14:00 Lunch			
Afternoon Session			
Chair: Prof. Xianhui Chen			
14:00 -14:50	Qikun Xue	Tsinghua University	Atomic Layer-Based Tunnelling Experiment Study of the Pairing Symmetry of Cuprates and Fe-Based Superconductors
14:50 -15:40	Yuanbo Zhang	Fudan University	High Temperature Superconductivity in Monolayer Cuprates
15:40 -16:00 Break			
Chair: Prof. Tao Xiang			
16:00 -16:50	Yanming Ma	Jilin University	Sodalite-Like Clathrate Hydrides at High Pressure and its Fate to Room-Temperature Superconductivity
16:50 -17:40	Vasily S. Minkov	Max Planck Institute for Chemistry, Mainz	Towards Room-Temperature Superconductivity: Hydrogen-Dominant Compounds
18:00 Dinner			

October 26, 2019, Saturday, M234, IOP

Morning Session

Chair: Prof. Brian Maple			
09:00 -09:50	Xianhui Chen	University of Science and Technology of China	Enhanced Cooper Pairing in the Two-Dimensional FeSe Based Superconductors
09:50 -10:40	Guanghan Cao	Zhejiang University	Superconductivity in Quasi-One-Dimensional Cr-Based Arsenide
10:40 -10:50 Break			
Chair: Prof. Yuanbo Zhang			
10:50 -11:40	Yoshihiro Iwasa	University of Tokyo	Gate-Induced 2D Superconductivity
11:40 -12:30	Jian Wang	Peking University	Quantum Metal States in Crystalline 2D Superconducting Films
12:30 -14:00 Lunch			

Afternoon Session

Chair: Prof. Jian Wang			
14:00 -14:50	Brian Maple	University of California, San Diego	Unconventional Superconductivity and Electronic Correlations in Pr-based “Cage” Compounds
14:50 -15:40	Guangyu Zhang	Institute of Physics, CAS	Observation of Superconductivity in Electrically Tunable Twisted Double Bilayer Graphene
15:40 -16:00 Break			
Chair: Prof. Yoshihiro Iwasa			
16:00 -16:50	Changqing Jin	Institute of Physics, Beijing	New High Tc Cuprate Superconductor with Unique Features
16:50 -17:40	Katsuya Shimizu	Osaka University	Study of Pressure-Induced Superconductivity and the Experimental Background
17:40 -18:00		Summary & Closing Remarks	
18:00 Dinner			

October 27, 2019

Excursion: The Great Wall + The Forbidden City.

October 25 08:40- 09:30

Superconductivity at Above the Maximum Temperature Predicted by the Universal Relation

C. W. Chu[1], L. Z. Deng[1], Y. P. Zheng[2], Z. Wu,[1] S. Y. Huyan[1], H. C. Wu[1], Y. F. Nie[2], and K. J. Cho[2]

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Raising the superconducting transition temperature T_c has been the main driving force in the sustained superconductivity research worldwide in the ensuing decades after its discovery. Various models to correlate certain parameters of the superconductors with T_c have been proposed. For example, one of the most cited and studied correlations has been the so-called universal quadratic relation for a superconductor that describes the variation of T_c with doping p, i.e. $T_c \propto T_c^{max} [1 - 82.6(p - p_o)^2]$, where T_c^{max} is the maximum T_c at the optimal dopant of p_o. The superconductor is known as under-doped, optimally doped or over-doped, when $p < p_o$, $p = p_o$ or $p > p_o$. This empirical relation has been demonstrated to work qualitatively well for high temperature superconductors (HTSs), especially for the cuprates by doping and/or the application of pressures. To date, HTSs display a stable T_c above 77 K are cuprates (the hydrite under ultrahigh pressures are not stable). Unfortunate, this implies that the highest T_c of the stable cuprates has been reached and capped below T_c^{max} in the universal relation. To overcome the T_c^{max}-cap, one has to change the electronic structure or Fermi surface topology[1] of cuprates to escape such constrain. Indeed, we have observed a universal T_c-rise in all three members of the BSCCO system under high pressures after their T_cs traverse the first T_c^{max} predicted by the universal T_c-p relation. The results[2] will be presented and discussed.

[1] C. W. Chu, T. F. Smith and W. E. Gardner, Phys. Rev. Lett. 20, 198 (1968)
[2] L. Z. Deng et al. PNAS 116, 12004 (2019)

October 25 09:30-10:20

Recent Advances of Iron-Based Wires and Tapes for High-Field Applications

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Iron-based superconductors (IBS) are of great interest for high-field applications, due to their lower anisotropies and ultrahigh upper critical fields. In recent years, tremendous progress has been made on the critical current density (Jc) of the 122-type IBS wires based on a powder-in-tube technique. Encouraging breakthroughs were made, including a high transport Jc exceeding the practical level of 10^5 A cm^{-2} (at 4.2 K, 10 T), the first 100 meter-class wire and the first performance test of a 30 mm IBS inserted coil under a 24 T background field. In this talk, I will review the state-of the-art techniques and their mechanism in realizing high transport Jc with respect to the grain connectivity, grain texture and flux pinning for IBS wires and tapes. We also highlight some remarkable advances relevant to practical applications, including mechanical strain properties, copper sheaths, multifilamentary fabrication, and superconducting joints.

October 25 10:40-11:30

Recent Progresses in Syntheses and Physical Properties of FeSe-Based Single Crystals and Films

Xiaoli Dong

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FeSe-based superconductors have drawn much attention because the FeSe block has been shown to harbor widely tunable T_c and rich physics. In order to investigate the intrinsic physical properties and their interplays with high-T_c superconductivity, we have developed a series of new hydrothermal methods capable of synthesizing FeSe-based single crystals and films, and tuning their superconducting and normal state characteristics. For examples, sizable single crystals of (Li,Fe)OHFe$_{1-x}$Se series have been prepared for the first time by a novel ion-exchange hydrothermal approach, high-quality (Li,Fe)OHFe$_{1-x}$Se films synthesized by inventing Matrix-assisted Hydrothermal Epitaxy (MHE) technique, and iron-deficient Fe$_{1-x}$Se single crystals of varying T_c obtained through an ion-deintercalation hydrothermal route. Owing to the breakthrough in sample preparation, we established the phase diagram for Li$_{1-x}$Fe$_x$OHFe$_{1-y}$Se system and observed an electronic phase separation. We also observed a strong electronic two-dimensionality and anomalous linear behavior in the electrical resistivity and magnetic susceptibility, and found that both the electron and hole components contribute to the electrical conduction in (Li,Fe)OHFe$_{1-x}$Se system. A positive correlation between the superconductivity and magnetic-field-induced spin nematicity was observed in FeSe system.

References

1. X.L. Dong, H.X. Zhou, F. Zhou, Z.X. Zhao *et al.* Phase Diagram of (Li$_{1-x}$Fe$_x$)OHFeSe: A Bridge between Iron Selenide and Arsenide Superconductors. *J. Am. Chem. Soc.* **137**, 66-69 (2015).
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3. D. N. Yuan, X.L. Dong, F. Zhou *et al.* Synthesis of large FeSe superconductor crystals via ion release/introduction and property characterization. *Chin. Phys. B* **25**, 077404 (2016).
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7. Y. Y. Mao, F. Zhou, X.L. Dong, Z.X. Zhao *et al.* Electronic Phase Separation in Iron Selenide (Li,Fe)OHFeSe Superconductor System. *Chin. Phys. Lett.* **35**, 057402 (2018).

October 25 11:30- 12:20

High-Tc Superconductivity by Metallizing Strong-Bonding Electrons

Tao Xiang

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The σ-bonding electrons have large binding energy and are stabilized by strong electron-phonon interaction. If one can lift the σ-bonding band up to the Fermi level, by chemical doping or other charging effects, the strong binding energy is released, but the residual electron-phonon interaction can still be very strong. This may lead to a novel strong phonon-mediated superconductor. Based on this picture, we predict a number of materials which have high potential to become high-Tc superconductors. The superconductivity in these materials arises predominantly from the coupling of the σ-bonding electrons with certain bond-stretching phonon modes.

October 25 14:00-14:50

Atomic Layer-Based Tunneling Experiment Study of the Pairing Symmetry of Cuprates and Fe-Based Superconductors

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We investigate the pairing mechanism of high Tc superconductivity with atomic-layer resolution in cuprates and iron-pnictides by using state-of-the-art molecular beam epitaxy (MBE)-scanning tunneling microscopy (STM) and exfoliation technique. With the techniques, we are able to study the gap structure and pairing symmetry of superconducting copper oxide and FeSe planes directly by STM, as well as Josephson tunneling down to few layers in junction structures. We show that the pairing symmetry in both systems is isotropic. We propose a model for understanding the mechanism of unconventional high temperature superconductivity.

October 25 14:50-15:40

High Temperature Superconductivity in Monolayer Cuprates

Yuan Bo Zhang

Department of Physics, Fudan University

The role of dimensionality in high Tc superconductivity is an interesting issue: many of the high Tc superconductor have layered atomic structures, and yet the link between the high Tc superconductivity and the two-dimensional nature of the crystal structure remains elusive. We fabricated atomically thin $Bi_2Sr_2CaCu_2O_{8+d}$ (Bi-2212) and $Bi_2Sr_2CuO_{6+d}$ (Bi2201) flakes, and used scanning tunneling microscopy/spectroscopy (STM/STS) to investigate their electronic structure. In this talk, I will discuss our recent results on the superconducting gap, pseudogap and charge order in Bi-2212 and Bi-2201 in the ultimate 2D limit.

October 25 16:00-16:50

Sodalite-like Clathrate Hydrides at High Pressure and its Fate to Room-Temperature Superconductivity

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Room-temperature superconductivity has been a long-held dream and an area of intensive research. Pressure comes to play an important role in stabilizing superconductive hydrogen-rich hydrides that become a subject of topic interest in the field recently [1]. Exciting experimental discoveries [2,3] were recently made with the guidance of theoretical searches [4,5] where the best ever-known superconductor of LaH_{10} with T_c reaching 260 K was reported.

In this talk, I will give an overview on the current status of research progress on superconductive hydrides, and then introduces the first-ever example of sodalite-like clathrate CaH_6 that was predicted by my group in 2012 [6]. Later on, I will present our theoretical predictions of a wide range of high T_c sodalite-like clathrate rare earth (RE) hydrides with stoichiometries of REH_6, REH_9, and REH_{10} that can be achieved at high pressures [4]. This prediction together with Ref. 5 stimulated the experimental discoveries of LaH_{10} with the measured T_c at ~260 K [2] and ~250 K [3], respectively. The scientific ideas on why we purposely choose RE hydrides and the general design principle for achieving high T_c superconductive hydrides will be discussed.

Before the end of the talk, I will present our very recent prediction on alternative clathrate structure in Li-Mg-H system [7] that has the calculated T_c at ~ 400 K, well beyond room-T. Experimental confirmation is apparently needed to verify this exciting prediction.

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October 25 16:50-17:40

Towards to Room-Temperature Superconductivity: Hydrogen-Dominant Compounds

Vasily S. Minkov and Mikhail I. Eremets

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More than a century has passed after the Onnes´s discovery of superconductivity in pure metals, however a search for superconductors with a critical temperature, T_c, close to room temperature is still great challenge and one of the hottest topics in physics. Guided by Niel Ashcroft´s general idea and supported by continuing development in computational methods for crystal structure prediction T_c of ~203 K was discovered in H_3S. This critical temperature is significantly higher than the long-standing record achieved in 1993 for an unconventional superconductor from cuprate family with the highest T_c of ~133 K at ambient pressure and and 164 K at high pressures.

In the present lecture we report the recent achievements and prospects in search for high-temperature superconductivity. We focus on our results on lanthanum and yttrium superhydrides with T_cs as high as 250 K at 150 GPa for LaH_{10}[1] and 243 K at 200 GPa for YH_9[2]. We also present new data on superconductivity in H_3S (D_3S) synthesized directly from elemental sulfur and hydrogen.[3] A particular attention is devoted to experimental methods and techniques for *in situ* chemical synthesis, transport electrical and magnetic susceptibility measurements at megabar pressures.

1 Drozdov, A. P. *et al.* Superconductivity at 250 K in lanthanum hydride under high pressures *Nature* (2019).

2 Kong, P. P. *et al.* Superconductivity up to 243 K in yttrium hydrides under high pressure. *arXiv:1909.10482* (2019).

3 Mozaffari, S. *et al.* Superconducting phase diagram of H_3S under high magnetic fields. *Nature Communications* **10**, 2522 (2019).

October 26 09:00- 09:50

Enhanced Cooper Pairing in the Two-Dimensional FeSe Based Superconductors

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In conventional superconductors, electron pairing and long-range phase coherence generally take place simultaneously, while the electron pairing occurs at much higher temperature than the long-range phase coherence in the underdoped high-T_c cuprate superconductors. Recently, we successfully synthesized two organic molecule intercalated FeSe based superconductors: $(CTA)_{0.3}FeSe$ (CTA: cetyltrimethyl ammonium) and $(TBA)_{0.3}FeSe$ (TBA: tetrabutyl ammonium) with T_c of 45 K and 50 K, respectively. With intercalating CTA^+ and TBA^+ ions between FeSe layers, the *c*-axis lattice constant were expanded to 14.5 and 15.5 Å, respectively, suggesting a highly 2D structure. This makes the organic molecule intercalated FeSe-based superconductors be the excellent system to study effect of dimensional crossover on superconducting pairing. Local spin susceptibility, diamagnetism and Nernst effect measurements unambiguously confirmed a persistent superconducting pairing above 60 K. Scanning tunneling microscope (STM) revealed a large superconducting gap of 16 meV, nearly the same as that observed in the single-layered FeSe film. Meanwhile, a BKT-like behavior was observed in *I*-*V* measurement across T_{c0} ~43 K. These findings evidence a dimensionality reduction enhanced electron pairing in highly 2D FeSe-based superconductors. These findings are very similar to the case for the underdoped cuprate superconductors.

October 26 09:50- 10:40

Superconductivity in Quasi-One-Dimensional Cr-Based Arsenides

Guang-Han Cao

Department of Physics, Zhejiang University

In this talk I will first overview superconductivity in quasi-one-dimensional (Q1D) crystalline materials $A_2Cr_3As_3$ (A = Na, K, Rb and Cs). Then I wish to clarity the possible superconductivity in the “cousin” materials ACr_3As_3 by presenting the latest progress—hydrogen incorporation. Finally, I will make a summary and an outlook on this topic.

October 26 10:50- 11:40

Gate-Induced 2D Superconductivity

Yoshihiro Iwasa[1,2*]

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Gate-induced superconductivity of an insulating $SrTiO_3$ using ionic gating was first realized in 2008 [1], ionic gating has been a powerful tool for making novel two-dimensional (2D) superconductors [2]. All the new 2D superconductors discovered in the present century, including the gate-induced ones, possess high crystallinity in sharp contrast to the conventional 2D superconductors with amorphous or granular structures. Thus, apart from the new superconductors, the gating technique has been a new platform of 2D superconductors reaches, and have found unique features, such as quantum metallic states and noncentrosymmetric 2D superconductivity [3]. After reviewing these features, we would like to touch on gate-controlled ultra-low carrier density 2D superconductivity.

References

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October 26 11:40- 12:30

Quantum Metal States in Crystalline 2D Superconducting Films

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After decades of explorations, suffering from the subtle nature and sample quality, whether a metallic ground state exists in a two-dimensional system (2D) beyond Anderson localization is still a mystery. Our work reveals how quantum phase coherence evolves across bosonic superconductor-metal-insulator transitions via magneto-conductance quantum oscillations in high-Tc superconducting films with patterned nanopores. A robust intervening anomalous metallic state characterized by both resistance and oscillation amplitude saturations in the low temperature regime is detected, which suggests that the saturation of phase coherence plays a prominent role in the formation of the anomalous metallic state.[1] Furthermore, Recent emergence of 2D crystalline superconductors has provided a promising platform to investigate novel quantum physics and potential applications. To reveal essential quantum phenomena therein, ultralow temperature transport investigation on high quality ultrathin 2D superconducting films is critically required. Here we report a systematic transport study on the macro-size ambient-stable ultrathin $PdTe_2$ films grown by molecular beam epitaxy [2]. Interestingly, a new type of Ising superconductivity in 2D centrosymmetric materials is revealed by the detection of large in-plane critical field more than 6 times Pauli limit. Remarkably, in perpendicular magnetic field, the film undergoes the quantum phase transition from quantum metal to weakly localized metal with the presence of intermediate quantum Griffiths singularity. Our findings lead to a global phase diagram of 2D superconducting system with strong spin-orbit coupling.

References

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[2] arXiv:1904.12719

October 26 14:00- 14:50

Unconventional Superconductivity and Electronic Correlations in Pr-Based “Cage” Compounds

M. Brian Maple

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Unconventional types of superconductivity (SC) have been observed in two classes of Pr-based “cage” compounds, $\mathrm{Pr}T_4X_{12}$ (T = Fe, Ru, Os, Pt; X = P, As, Sb, Ge) “filled skutterudites” [1] and $\mathrm{Pr}T_2X_{20}$ (T = Ti, V, Co, Rh, Ir, Ni, Pd, Pt; X = Zn, Cd, Al) “1-2-20” compounds [2]. The hybridization of the localized 4*f*-electron states of the Pr “guest” ions with the ligand states of the surrounding ions of the “atomic cages” within which the Pr ions reside leads to strong electronic correlations. The “filled skutterudite” compounds $\mathrm{PrOs_4Sb_{12}}$ [3] and $\mathrm{PrPt_4Ge_{12}}$ [4] exhibit unconventional SC, with SCing critical temperatures (T_c’s) of 1.86 K and 7.9 K, respectively. The SC arises from multiple bands, appears to have gap nodes, and breaks time reversal symmetry; both compounds are nonmagnetic with Pr^{3+} singlet crystalline electric field (CEF) ground states. The “1-2-20” compounds $\mathrm{PrTi_2Al_{20}}$ [5], $\mathrm{PrV_2Al_{20}}$ [6], $\mathrm{PrRh_2Zn_{20}}$ [7], and $\mathrm{PrIr_2Zn_{20}}$ [8] have been reported to display unconventional SC with T_c’s of 0.2 K, 0.06 K, 0.05 K, and 0.05 K, respectively. The SC coexists with ferroquadrupolar (FQ) order in $\mathrm{PrTi_2Al_{20}}$ (T_{FQ} = 2 K) and antiferroquadrupolar (AFQ) order in $\mathrm{PrV_2Al_{20}}$, $\mathrm{PrRh_2Zn_{20}}$, and $\mathrm{PrIr_2Zn_{20}}$ (T_{AFQ} = 0.6 K, 0.06 K, and 0.11 K, respectively). We review recent experiments in which Ce [9] and Eu [10] substitutions for Pr have been used to probe the unconventional SC and electronic correlations in the filled skutterudite compound $\mathrm{PrPt_4Ge_{12}}$ by means of electrical resistivity, magnetic susceptibility, and specific heat measurements as a function of Ce and Eu substituent composition x, temperature T and magnetic field H. Experiments on the $\mathrm{Pr_{1-x}Ce_xPt_4Ge_{12}}$ system reveal a depression of T_c with x with positive curvature that is reminiscent of pair weakening interactions or the interplay between SC and the Kondo effect with a large Kondo temperature $T_K >> T_c$ [11]. Specific heat measurements on the $\mathrm{Pr_{1-x}Ce_xPt_4Ge_{12}}$ system [12] indicate that SC develops in at least two bands, and the SCing order parameter has nodes on one Fermi pocket and remains fully gapped on the other. Both the nodal and nodeless gaps decrease with increasing Ce concentration with a rate of suppression that is larger for the nodal gap. Experiments on the $\mathrm{Pr_{1-x}Eu_xPt_4Ge_{12}}$ system reveal a depression of T_c with x with negative curvature indicative of SCing electron pairbreaking by divalent Eu ions which carry localized magnetic moments of 7 μ_B. Specific heat measurements on the $\mathrm{Pr_{1-x}Eu_xPt_4Ge_{12}}$ system [13] reveal the presence of short-range AFM correlations between Eu ions under the SCing dome for $x \leq 0.5$ and long-range AFM order for $x \geq 0.5$. SC and AFM most likely coexist for $0.3 \leq x \leq 0.6$. The SCing gap has line nodes for $0 \leq x \leq 0.1$ and is isotropic for $0.15 \leq x \leq 0.5$. The Pr^{3+} ground state in the CEF in the $\mathrm{Pr}T_2\mathrm{Al}_{20}$ (T = Ti, V) and $\mathrm{Pr}T_2\mathrm{Zn}_{20}$ (T = Rh, Ir) compounds is a nonmagnetic non-Kramers doublet, which, when coupled with the hybridization between the localized Pr^{3+} 4*f* electron states and the ligand states of the 16 surrounding Al or Zn cage ions, sets the stage for a quadrupolar Kondo effect, which was first explored in compounds containing U ions [14-16]. We discuss the evidence for a quadrupolar Kondo effect in Pr-based "1-2-20" compounds based on measurements of their low temperature physical properties.

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October 26 14:50- 15:40

Observation of Superconductivity in Electrically Tunable Twisted Double Bilayer Graphene

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Electron-electron interactions play an important role in graphene and related systems to induce exotic quantum states, especially in a stacked bilayer with a small twist angle. Under a magic twist angle in a bilayer graphene, flat band and strong many-body effects would lead to Mott-like insulating states and emergent superconductivity. Different from monolayer graphene, the band structure of AB-stacked bilayer graphene can be further tuned by electric-fields, providing an extra knob to realize the flat band in addition to the very sensitive twist angle. In this talk, I presents our recent results on the characterization of such electrically tunable twisted double bilayer graphene. Insulating states at half-filling and superconductivity with onset Tc at 12K, much higher than those observed in any other graphene structures, are observed. Furthermore, the resistance gap in the Mott insulator increases with respect to the in-plane magnetic fields and the as-measured g factor of ~2 suggests possible ferromagnetic fluctuations in the Mott phase which might mediate the corresponding unconventional pairing mechanism in the superconductivity phase observed in our system. These results establish the twisted double bilayer graphene as easily tunable platform for exploring new paradigm of quantum many-body states.

October 26 16:00- 16:50

New High Tc Cuprate Superconductor with Unique Features

Changqing Jin

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The discovery of high Tc copper oxide (cuprate) superconductors leads to the new paradigm of superconductivity while it continues to be the only family so far showing superconductivity above liquid nitrogen at ambient pressure. The cuprate superconductors crystallize into layered perovskite structure featured with elongated copper oxygen local coordination due to Jahn Teller effects & strong interlayer Coulomb interactions leading to the general scenario that 3dx2-y2 orbital far above 3dz2-r2 favors to superconductivity. We will introduce in the talk the Ba2CuO4-y new superconductor synthesized at high oxygen pressures with compressed local coordination wherein 3dz2-r2 orbital is lifted above 3dx2-y2 in sharp contrast to the previous configurations but shows superconductivity at room pressure with Tc more than 80% higher than that for isostructure counterpart based on La2CuO4.

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October 26 16:50- 17:40

Study of Pressure-Induced Superconductivity and the Experimental Background

Katsuya Shimizu

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Synthesis of RTS, room-temperature superconductor (superconducting at temperature higher than room temperature) is one of the goals of science and technology. “Pressure” is one of the powerful tools for the study of a superconductor to improve the superconducting property, and to make non-superconducting material to superconductive. We have known that most of the superconducting materials show a negative pressure dependence in the superconducting temperature, Tc. But we found some elements show a positive. In my talk, the experimental investigations of pressure-induced superconductivity with our developments of high-pressure technique combined with low-temperature equipment will be reviewed. The recent results of the onset of new superconductivity exceeding 200 K under pressures will also be presented.

Meeting Venue

Building M, Room 234, Institute of Physics (IOP), Chinese Academy of Sciences
Address: No.8, 3rd South Street, Zhongguancun, Haidian District, Beijing 100190, China

The building M of IOP is close to the LiaoNing International Hotel—about 10 minutes walking distance. In the Morning of October 25, we will arrange people to guide you from the LiaoNing International Hotel to the meeting venue.

Transport from the Airport to the Hotel

The hotel is LiaoNing International Hotel（辽宁大厦）,

http://www.liaoninginternationalhotel.com

Address: No.2 A North 4th Ring Road West, Haidian District, Beijing

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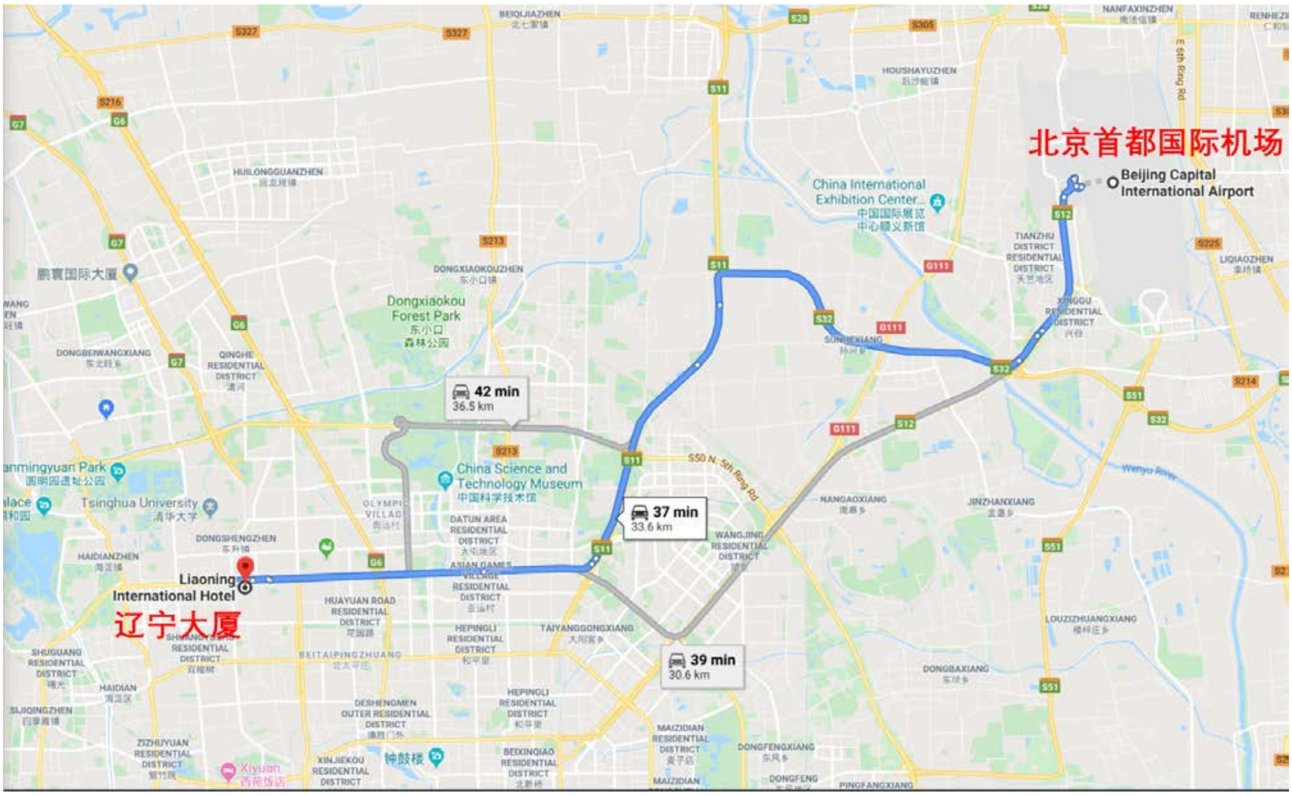
It is convenient to get to LiaoNing International Hotel from the Beijing Capital International Airport is by taxi, which costs ~RMB 100 with no tips required. Since it is straightforward to get to the LiaoNing International Hotel from the Beijing International Airport by Taxi, we will NOT arrange pick-up at the Airport. We have made a map below showing the way from the airport to the hotel. On the map the name of the hotel is written in Chinese so you can show to the Taxi Driver. In case you have any problems, please contact: Ms Lingqian WANG at the cell phone: 86-15210902192, or Xingjiang Zhou at the cell phone: 86-13810857154.



Conference Excursion

The meeting will organize one-day tour in Beijing on October 27, 2019, after the scientific program. If you are interested, please inform the organizers of the meeting.

Forbidden City:

The Forbidden City was the Chinese imperial palace from the Ming Dynasty to the end of the Qing Dynasty. It is located in the middle of Beijing, China, and now houses the Palace Museum. For almost 500 years, it served as the home of emperors and their households, as well as the ceremonial and political center of Chinese government. Built in 1406 to 1420, the complex consists of 980 buildings with 8,707 bays of rooms and covers 720,000 m2 (7,800,000 sq ft). The palace complex exemplifies traditional Chinese palatial architecture,[2] and has influenced cultural and architectural developments in East Asia and elsewhere. The Forbidden City was declared a World Heritage Site in 1987, and is listed by UNESCO as the largest collection of preserved ancient wooden structures in the world. Since 1925, the Forbidden City has been under the charge of the Palace Museum, whose extensive collection of artwork and artifacts were built upon the imperial collections of the Ming and Qing dynasties. Part of the museum's former collection is now located in the National Palace Museum in Taipei. Both museums descend from the same institution, but were split after the Chinese Civil War.
More detailed information can be found in
http://en.wikipedia.org/wiki/Forbidden_City

Great Wall:

The Great Wall of China is a series of stone and earthen fortifications in northern China, built originally to protect the northern borders of the Chinese Empire against intrusions by various nomadic groups. Several walls have been built since the 5th century BC that are referred to collectively as the Great Wall, which has been rebuilt and maintained from the 5th century BC through the 16th century. One of the most famous is the wall built between 220–206 BC by the first Emperor of China, Qin Shi Huang. Little of that wall remains; the majority of the existing wall was built during the Ming Dynasty. The Great Wall stretches from Shanhaiguan in the east, to Lop Lake in the west, along an arc that roughly delineates the southern edge of Inner Mongolia. The most comprehensive archaeological survey, using advanced technologies, has concluded that the entire Great Wall, with all of its branches, stretches for 8,851.8 km (5,500.3 mi). This is made up of 6,259.6 km (3,889.5 mi) sections of actual wall, 359.7 km (223.5 mi) of trenches and 2,232.5 km (1,387.2 mi) of natural defensive barriers such as hills and rivers.
More detailed information can be found in
http://en.wikipedia.org/wiki/Great_Wall_of_China