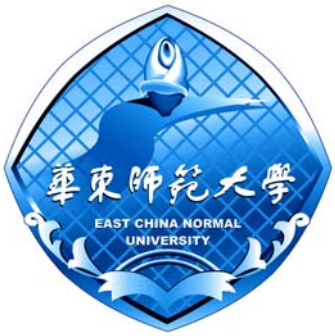
International Conference on Mathematical Theory of Superconductivity and Liquid Crystals

超导与液晶的数学理论国际会议

Program



华东师范大学数学系

EAST CHINA NORMAL UNIVERSITY

2007.5.14-5.18

SHANGHAI • CHINA

International Conference
on Mathematical Theory of Superconductivity and Liquid Crystals

超导与液晶的数学理论国际会议

http://www.math.East China Normal University.edu.cn/SCLC-Conf

May 14-18,2007 ECNU, Shanghai

Conference Venue: ECNU, Science Building, Room A504

Scientific Committee

Haim Brezis, Shuxing Chen, Weiyue Ding, Yoshikazu Giga, Bolin Guo, Robert Hardt, Bernard Helffer, Jiaxing Hong, Lishang Jiang, Daqian Li, Fanghua Lin (Chair), W.M. Ni, Xingbin Pan

Organizing Committee

Bernard Helffer (Chair), Xingbin Pan, Xueping Wang, Danping Yang, Feng Zhou (Co-Chair)

Sponsored By:

Natural Science Foundation of China
National Basic Reserch Program of China
East China Normal University,China

Dinner Place: YiFu Hotel
Breakfast Time：6:30—8:30
Lunch Time: 12:30—2:00pm
Dinner Time: 6: 00pm

City tour and Banquet:

Taking bus in front of the YiFu Hotel at 1:30pm on Wednesday 16th

One day tour to Zhou Zhuang:

Taking bus in front of the YiFu Hotel at 8:30 am on Friday 18th

E-Mail Room：Science Building, Room A1409 and A1411,

From 8:30 am -- 8:00pm, Monday to Friday.

Conference Schedule

	Monday 14th	Tuesday 15th	Wednesday 16th	Thursday 17th	Friday 18th
8:50-9:00	Opening				
9:00-10:00	F.H.Lin	P. Bates	R. Hardt	P. Bauman	
10:00-10:20	Tea break				
10:20-11:20	P. Sternberg	S. Jimbo	T. Riviere	P. Lin	
11:30-12:30	S. Serfaty	V. Bonnaillie-Noel	X.P. Wang	X.B. Pan	
12:30-2:00	Lunch				
2:00-3:00	M. Calderer	F. Bethuel	City tour	H. Matano	
3:00-3:20	Tea break			Tea break	
3:20-4:20	L. Bronsard	Y. Morita		B. Helffer	
4:30-5:30	J.Rubinstein	Y. Almog		Q. Du	

May 14 Monday, Morning session (Chair: Lishang Jiang)

Fanghua Lin, On a problem posed by Keller-Rubinstein-Sternberg

Peter Sternberg, Critical points via Gamma-convergence with applications to Modica-Mortola and Ginzburg-Landau

Sylvia Serfaty, A gradient-flow approach for a mean field model of superconductivity

May 14 Monday, Afternoon session (Chair: Bernard Helffer)

Maria-C. Calderer, Modeling and analysis of liquid crystal elastomers

Lia Bronsard, Global minimizers of the Lawrence-Doniach model with oblique external field

Jacob Rubinstein, The resistive state of a superconducting wire

May 15 Tuesday, Morning session (Chair: Shuxing Chen)

Peter Bates, Nucleation of instability of the Meissner state of a three dimensional superconductor

Shuichi Jimbo, Ginzburg-Landau equation in thin domains

V. Bonnaillie-Noel, superconductivity in domains with corners

May15 Tuesday, Afternoon session (Chair: Robert Hardt)

Fabrice Bethuel, Transonic traveling waves for the Gross-Pitaevskii equation

Yoshihisa Morita, Bifurcation of vortex solutions in a Ginzburg-Landau model for small kappa

Yaniv Almog, Stability of the normal state of superconductors in the presence of electric currents

May 16 Wednesday, Morning session (Chair: Danielle Hilhorst)

Robert Hardt, Some remarks on W^{2,2} maps

Tristan Riviere, Analysis aspects of Willmore surfaces

Xue-Ping Wang, On the quantum Efimov effect

May 16 Wednesday, Afternoon: City tour

May 17 Thursday, Morning session (Chair: Hiroshi Matano)

Patricia Bauman, Analysis and stability of bent-core liquid crystals

Ping Lin, Finite element methods for molecule orientations of liquid crystals and liquid crystal flows

Xingbin Pan, Critical elastic coefficient of liquid crystals and hysteresis

May 17 Thursday, Afternoon session (Chair: Peter Bates)

Hiroshi Matano, A braid group method for blow-up in nonlinear heat equations

Bernard Helffer, Strong diamagnetism for general domains in R^3 and applications (After S. Fournais and B. Helffer)

Qiang Du, Ginzburg-Landau-Schrodinger dynamics of quantized vortices

International Conference on Mathematical Theory of Superconductivity and Liquid Crystals

May 14-18, 2007, ECNU, Shanghai

Titles and Abstracts

Stability of the Normal State of Superconductors in the Presence of Electric Currents

Yaniv Almog

Department of Mathematics, Louisiana State University,
Baton Rouge, LA 70803, USA

The stability of the normal state of superconductors in the presence of electric currents is analyzed within the framework of the time-dependent Ginzburg-Landau equations. We consider the large domain limit. Among other things we show that the stability picture obtained in the one-dimensional case by physicists in the early 80's is preserved in this limit for general three-dimensional sample geometry and boundary conditions. Some attention would be given to the effect of applied magnetic fields.

Nucleation of Instability of the Meissner State of a Three Dimensional Superconductor

Peter Bates

Department of Mathematics, Michigan State University,
East Lansing, MI 48824, USA

Abstract This talk represents joint work with Xingbin Pan concerning a nonlinear partial differential system in a three-dimensional domain involving the operator curl^2. This system is a simplified model used to examine nucleation of instability of the Meissner state of a superconductor as the applied magnetic field reaches the superheating field. We derive a priori $C^{2+\alpha}$ estimates for a weak solution $\mathbf{H}$, the curl of the magnetic potential, and determine the location of the maximal points of $|\mathrm{curl}\mathbf{H}|$ which correspond to the nucleation of instability of the Meissner state. We show that, if the penetration length is small, the solution exhibits a boundary layer. If the applied magnetic field is homogeneous, $|\mathrm{curl}\mathbf{H}|$ is maximal around the points on the boundary where the applied field is tangential to the surface.

Analysis and Stability of Bent-Core Liquid Crystals

Patricia Bauman

Department of Mathematics, Purdue University,
W. Lafayette, IN 47907, U.S.A

We present a variational model for bent-core (banana-shaped) liquid crystals. The model includes contributions to the energy resulting from polarization, smectic and chiral effects, elasticity, and surface tension. We analyze solutions obtained via Gamma-convergence including their stability.

Transonic Traveling Waves for the Gross-Pitaevskii Equation

Fabrice Bethuel

Department of Mathematics, University of Paris VI,
75005 Paris, France

The Gross-Pitaevskii equation, which is a nonlinear Schrodinger(NSL) equation was introduced to model various phenomena in physics, in particular Bose-Einstein condensation and possibly also superfluidity. In contrast with the usual NLS equation, finite energy solution on the whole space do not tend to zero at infinity, but instead their modulus tends to one. The equation bears some analogy with the Euler equation of compressible fluid, in particular there is a notion similar to the speed of sound.

In this talk I will discuss various problems related to traveling wave solutions, whose speed is close to the speed of sound. I will focus in particular on the existence problem. Our approach uses calculus of variation as well as the asymptotic analysis of the equation (the formal asymptotic limit being given by the KP equation).

This is a joint ongoing work with Philippe Gravejat (Université Paris-Dauphine) and Jean-Claude Saut (Université d'Orsay).

Global Minimizers of the Lawrence-Doniach Model with Oblique External Field

Lia Bronsard

Department of Mathematics and Statistics, McMaster University,
Ontario, L8S 4K1 Canada

We study periodic minimizers of the Lawrence-Doniach model for layered superconductors, in various limiting regimes. We are particularly interested in determining the direction of the internal magnetic field (and vortex lattice) as a function of the applied external magnetic strength and its orientation with respect to the superconducting planes. We identify the corresponding lower critical fields, and compare the Lawrence-Doniach and anisotropic Ginzburg-Landau minimizers in the periodic setting. This talk represents work in progress with S. Alama and E. Sandier.

Superconductivity in Domains with Corners

V. Bonnaillie-Noël

Department of Mathematics, University de Rennes,
35042 Rennes Cedex, France

We study the two-dimensional Ginzburg-Landau functional in a domain with corners for exterior magnetic field strengths near the critical field where the transition from the superconducting to the normal state occurs.

Before carrying through an analysis similar to the one in [FoHe], we focus on the linear spectral problem (see [BoDa, BDRM]): The Neumann realization for the Schrödinger operator with magnetic field is considered in a bounded two-dimensional domain with corners. This operator is associated with a small semi-classical parameter h or, equivalently, with a large magnetic field. We investigate the behavior of its eigenpairs as h tends to zero, like in a semi-classical limit. We prove, in the situation where the domain is a polygon and the magnetic field is constant, that the lowest eigenvalues are exponentially close to those of model problems associated with the corners. We approximate the corresponding eigenvectors by linear combinations of functions concentrated in corners at the scale $\sqrt{h}$. If the domain has curved sides and the magnetic field is smoothly varying, we exhibit a full asymptotics for eigenpairs in powers of $\sqrt{h}$. We illustrate these results by numerical computations on polygons.

Using the linear eigenvalue problem, we clarify the definition of the critical field and obtain a complete asymptotic expansion for it in the large κ regime in terms of linear spectral data. Furthermore, we discuss nucleation of superconductivity at the boundary and establish precise estimates on the location of nucleation for magnetic field strengths just below the critical field (see [BoFo]).

[BoDa] V. Bonnaillie-Noël and M. Dauge, *Asymptotics for the low-lying eigenstates of the Schrödinger operator with magnetic field near corners*, Ann. Henri Poincaré, **7** (2006), 899-931.

[BDMV] V. Bonnaillie-Noël, M. Dauge, D. Martin and G. Vial, *Computations of the first eigenpairs for the Schrödinger operator with magnetic field*, To appear in Comput. Methods Appl. Mech. Engng., (2007).

[BoFo] V. Bonnaillie-Noël and S. Fournais, *Superconductivity in domains with corners*, Prépublication IRMAR 10-07 (2007).

[FoHe] S. Fournais and B. Helffer, *On the third critical field in Ginzburg-Landau theory*, Comm. Math. Phys., **266** (2006), 153-196.

Modeling and Analysis of Liquid Crystal Elastomers

Maria-C. Calderer

School of Mathematics, University of Minnesota,
Minneapolis, MN 55455USA

This presentation concerns modeling and analysis of static problems of liquid crystal elastomers. From the physical view point, these consist of polymeric networks with side monomers, that is, rigid and elongated molecules, attached to the network, and able to yield liquid crystal phases. As a result, molecular ordering of side monomers causes elastic deformation, and viceversa. This gives rise to the phenomenon of soft elasticity, that is, the material capability of experiencing very large deformations along preferred directions of strech, with very little energy. In previous work, De Simone, Conti and Doltzmann studied the soft elasticity phenomenon in terms of the anisotropic Gaussian elasticity model developed by Blandon, Warner and Terentjev, giving analytical and numerical characterization of the chevron pattern arising in elongational experiments. We present and analyze a regularization form of the previous energy to account for memory effects at crosslinking, liquid crystal elasticity and mesoscopic deformation of elastic networks, with the goal of characterizing length scales of patterns. The work discussed here is joint with Chun Liu, Baisheng Yan and Aaron Yip.

Ginzburg-Landau-Schrodinger Dynamics of Quantized Vortices

Qiang Du

Department of Mathematics, Penn State University,
University Park, PA 16802, USA

In this talk, motivated by studies on superconductivity and Bose-Einstein condensates, we present some recent works on the Ginzburg-Landau-Schrodinger dynamics of quantized vortices. Some open questions will be discussed.

On the Definition and Calculation of H_{C_3}

Soeren Fournais

Department of Mathematical Science, University of Aarhus,
Ny Munkegade, DK-8000 Aarhus C, Denmark

I will discuss the different possible definitions of the third critical field H_{C_3} for superconductivity in the Ginzburg-Landau model. The main result is that the different definitions give the same value when the de Gennes parameter κ is sufficiently large. If time permits I will show how this result applies to the case of superconductors with corners and to the three dimensional case.

This talk is based on joint work with B. Helffer and V. Bonnaillie-Noel.

Some Remarks on $W^{2,2}$ Maps

Robert Hardt

Department of Mathematics, Rice University
Houston, TX 77251, USA

In joint work with T. Riviere (ETH) we consider bubbling phenomena for sequences of smooth maps from the 5 ball to the 3 sphere with uniformly bounded Hessian energies. We show how to obtain from a subsequence a finite-length 1 dimensional bubbled chain whose boundary forms the topological singularities of the limit map. This leads to the weak $W^{2,2}$ density of smooth maps in the space of $W^{2,2}$ Sobolev maps. Other constructions lead to results, in joint work with CY Wang (Kentucky) on Hessian energy-minimizing maps.

Strong Diamagnetism for General Domains in $\mathbb{R}^3$ and Applications (After S. Fournais and B. Helffer)

Bernard Helffer

Laboratoire de Mathématiques, Université de Paris XI (Paris Sud),
91405 Orsay, France

We consider the Neumann Laplacian with constant magnetic field on a regular domain. Let B be the strength of the magnetic field, and let $\lambda_1(B)$ be the first

eigenvalue of the magnetic Neumann Laplacian on the domain. It is proved that $B \mapsto \lambda_1(B)$ is monotone increasing for large B.

This result was proved by Fournais-Helffer in the case of dimension 2 (first under a generic assumption, one year later in full generality). Our purpose (this is again a common work with S. Fournais) is to show here how one can prove the same result in dimension 3 (but under generic assumptions). The proof depends heavily on the two term asymptotics of $\lambda_1(B)$ obtained by Pan and Helffer-Morame in 2002.

Ginzburg-Landau Equation in Thin Domains

Shuichi Jimbo

Department of Mathematics, Hokkaido University,
Sapporo, Hokkaido 060-0810, Japan

I deal with Ginzburg-Landau equations in 3D thin domains. I consider critical points as well as local minimizers of GL energy functional. I relate them with the simplified problem on a lower dimensional domain which is the limit of thin 3D domain.

On a Problem Posed by Keller-Rubinstein-Sternberg

Fanghua Lin

Courant Institute of Mathematical Sciences, New York University
New York, NY 10012, USA

The evolutionary phase field equations of the Ginzburg-Landau type which model a fast reaction and a slow diffusion dynamic were carefully studied by Keller-Rubinstein-Sternberg about 20 years ago. There were much more systematic and theoretical studies after their works. Except a few cases, most of works thus far assumed that the potential-well set (that captures the limits of phase fields) is a smooth, connected manifold. However, in several applications, such potential well sets are often disconnected, and it is also of interest to study from the theoretical point of view. This problem was arisen in the very first paper of Keller-Rubinstein-Sternburg on the subject. The aim of this talk is to describe some progress on the problem. Part of it is from my earlier discussions with Xingbin Pan and Changyou Wang.

Finite Element Methods for Molecule Orientations of Liquid Crystals and Liquid Crystal Flows

Ping Lin

Department of Mathematics, National University of Singapore,
117543, Singapore

The liquid crystal molecule orientation is arranged by minimizing so-called Oseen-Frank energy functional. The energy is nonconvex due to the unit-length constraint of liquid crystal molecules and the constraint may be treated by the penalty method. Operator-splitting may be efficient to deal with 2D problem. But for 3D a faster and more efficient method is required. A pseudo-Newton method with a multi-grid linear system preconditioner is used to compute the solution. Due to small parameters in the model and singularities in the solution a homotopy algorithm combined with a mesh refinement strategy (based on a posteriori error estimate) is found to be very robust for both 2D and 3D simulations. The liquid crystal flow is a coupling between a director field (molecule orientation) of liquid crystals and a flow field. The model is also related to phase field models in computing multiphase flows. It is crucial to preserve the energy law of the system in numerical simulation, especially when orientation singularities are involved. We present a discrete energy law preserving C0 finite element method. It is of second order and matrix free in time. A number of liquid crystal flow examples (including small and large molecule cases) are computed to demonstrate the algorithm.

A Braid Group Method for Blow-Up in Nonlinear Heat Equations

Hiroshi Matano

Graduate School of Mathematical Sciences, University of Tokyo
Meguro, TOKYO 153, Japan

In this talk I will present an intriguing application of the braid group theory to the study of blow-up in a nonlinear heat equation $u_t = \Delta u + u^p$, where p is supercritical in the Sobolev sense. The goal is to determine all the type II blow-up rates by analyzing the topological properties of certain braids.

Bifurcation of Vortex Solutions in a Ginzburg-Landau Model for Small Kappa

Yoshihisa Morita

Department of Applied Mathematics and Informatics, Ryukoku University,
Seta Otsu, 520-2194 Japan
E-mail:morita@rins.ryukoku.ac.jp

We are dealing with the following 2-dimensional Ginzburg-Landau equation, which is a simplified model for the complex order parameter ψ with a uniform applied field $H_{ext} = (0, 0, h)$ vertical to a planar strip domain:

$$(\nabla - ihA_0)^2\psi + \kappa^2(1 - |\psi|^2)\psi = 0, \quad (x, y) \in (0, L_1) \times \mathbb{R},$$

where $A_0 := (0, x)$ ($\mathrm{curl}(hA_0, 0) = H_{ext}$) and κ corresponds to the Ginzburg-Landau parameter. We assume the periodicity in y-direction and consider the equation subject to the boundary conditions

$$\begin{cases} \psi(x, y + L_2) = \psi(x, y), & (x, y) \in (0, L_1) \times \mathbb{R}, \\ \partial\psi/\partial x = 0, & x = 0, L_1, \quad y \in \mathbb{R}. \end{cases}$$

It is easy to see that in the parameter space $(h, \lambda), \lambda := \kappa^2$, there is a curve $\lambda = \mu_k(h)$ ($k \geq 0$) on which a k-mode solution with positive amplitude bifurcates from the trivial solution, where the k-mode solution is given in the form

$$\psi = W(x) \exp(2k\pi iy/L_2), \quad W(x) > 0.$$

This k-mode solution is vortexless solution, namely it has no zeros. Investing a local bifurcation structure in a neighborhood of an intersection point of the two curves $\lambda = \mu_k(h)$ and $\lambda = \mu_m(h)$ ($m > k \geq 0$), we exhibit a solution with zeros, a vortex solution, for the parameters in a sectorial region. Moreover, the equation allows a solution with a zero on the boundary $\{x = 0\}$ or $\{x = L_1\}$ if the parameters lie on an appropriate curve emanating from the intersection point. We also discuss the stability of those solutions. The main results are given in a recent joint work with Chao-Nien Chen (National Changhua Univ. Education, Taiwan).

Critical Elastic Coefficient of Liquid Crystals and Hysteresis

Xingbin Pan

Department of Mathematics, East China Normal University,
Shanghai 200062, China

P. G. de Gennes predicted analogies between the effect of elastic coefficients to liquid crystals and the effect of applied magnetic fields to superconductors, and predicted that all elastic coefficients diverge to infinity at smectic-C to nematic transition. One would expect quantitative comparison in the analogies. In the case of equal elastic coefficients ($K_1 = K_2 = K_3 = K$), we define the critical value K^c and make comparison of it with the upper critical magnetic field H_{c_3} for type II superconductors. We classify smectic liquid crystals into subcritical, critical and supercritical cases according to the Ginzburg-Landau parameter κ, the wave number q and the boundary value of the director at surface. We show that in the subcritical case the liquid crystal does not undergo phase transition; and in the supercritical case both phase transition and hysteresis occur. The prediction of De Gennes is true in the critical case where $\mu_\pi(\mathbf{u}_0, q) = \kappa^2$ and $K^c = \infty$.

Analysis Aspects of Willmore Surfaces

Tristan Riviere

Department of Mathematics, ETH,
Zentrum 8092 Zurich, Switzerland

We found a new formulation to the Euler-Lagrange equation of the Willmore functional for immersed surfaces in $\mathbb{R}^m$. This new formulation of Willmore equation appears to be of divergence form, moreover, the non-linearities are made of jacobians. Additionally to that, if $\vec{H}$ denotes the mean curvature vector of the surface, this new form writes $\mathcal{L}\vec{H} = 0$ where $\mathcal{L}$ is a well defined locally invertible elliptic self-adjoint operator. These 3 facts have numerous consequences in the analysis of Willmore surfaces. One first consequence is that the long standing open problem to give a meaning to the Willmore Euler-Lagrange equation for immersions having only L^2 bounded second fundamental form is now solved. We then establish the regularity of weak Willmore immersion with L^2 bounded second fundamental form. The proof of this result is based on the discovery of conservation laws for Willmore immersions which are preserved under weak convergence. We establish then a weak compactness result for Willmore surfaces of energy less than 8π (the Li-Yau condition which ensures the embeddedness of the surface). This theorem is based on a point removability result we prove for Wilmore surfaces in $\mathbb{R}^m$. Finally, we deduce from this point removability result the strong compactness, modulo the Möbius group action, of Willmore tori below the energy level 8π in dimensions 3 and 4.

The Resistive State of a Superconducting Wire

Jacob Rubinstein

Department of Mathematics, Indiana University,
Bloomington, IN 47405, USA

I shall consider the canonical problem of a one-dimensional superconducting wire of finite length. A constant current I is fed into the wire. The problem is modeled by the time-dependent Ginzburg Landau equations. I shall survey a number of recent results including the bifurcation from the normal state, the existence of time-periodic solutions, the formation of phase slip centers and the coexistence of pairs of metastable states.

A Gradient-Flow Approach for a Mean Field Model of Superconductivity

Sylvia Serfaty

Courant Institute of Mathematical Sciences, New York University,
New York, NY 10012, USA

In a joint work with Luigi Ambrosio, we study an evolution equation proposed by Chapman-Rubinstein-Schatzman as a mean-field model for the evolution of the vortex-density in a superconductor. We consider the case of a bounded domain where vortices can exit or enter the domain. We show that the equation can be derived rigorously as the gradient-flow of a specific energy for the Riemannian structure induced by the Wasserstein distance on probability measures. This leads to some existence and uniqueness results and energy-dissipation identities. We also exhibit some "entropies" which decrease along the flow and allow to get regularity results.

Critical Points via Gamma-Convergence with Applications to Modica-Mortola and Ginzburg-Landau

Peter Sternberg

Department of Mathematics, Indiana University,
Bloomington, IN 47405, USA

Gamma-convergence is generally viewed as a powerful tool for the study of minimizers of sequences of variational problems. Here we exhibit its use as a tool for producing (unstable) critical points as well. Applications will focus of 3d Ginzburg-Landau and 2d Modica-Mortola. This is joint work with Robert Jerrard.

On the Quantum Efimov Effect

Xue-Ping Wang

Département de Mathématiques, Université de Nantes,
44322 Nantes Cedex, France

The Efimov effect for three-particle systems is one of the most striking phenomena in few-body quantum mechanics and is thoroughly studied. For quantum systems with four or more particles, there are controversies in physical literature about the existence of similar phenomenon. In this talk, I will present some mathematical results on the existence of the Efimov effect for quantum systems with four or more particles.

City Sightseeing

Shanghai Museum

Present Special exhibitions: *Art in America: Three Hundred Years of Innovation.* (May 1 to June 30, 2007)

Open time: 9 a.m.-5 p.m. everyday. (Last entry at 4 p.m.)

Common Ticket: 20 RMB Yuan (The museum also provides multi-language guide service by pay additional fees.)

Two ways to get there:

(1) Take a taxi;

(2) Take taxi or BUS 765[1] to Zhongshan Park Station, then take Metro Line 2 to People's Square Station.

上海博物馆

最新特展：*美国艺术三百年*（2007 年 5 月 1 日-6 月 30 日）

开放时间：每天上午 9 点-下午 5 点（下午 4 点停止进场）

普通票价：20 元（60 元套票同时提供多种语言导览设备）

交通路线：

(1) 乘出租车直接前往。

(2) 乘出租车或者 765[1]路公交车到中山公园换乘轨道交通 2 号线到人民广场下车。

Huangpu River and the Bund

For a view of old and modern Shanghai

外滩

观赏上海的旧貌新颜

Yu Garden

For a famous classical garden built about 430 years ago, delicious food and Chinese goods (small articles, local crafts and so on).

There are several famous restaurants near Yu garden, see the part of ***Eat***

豫园

它始建于 430 年前，是著名的传统园林。在那里你可以品尝到地道美味的食物，也有琳琅满目的中国手工饰品供您选择。

豫园附近有一些著名的饮食店，详见后面的*饮食*部分。

Oriental Pearl TV Tower and Jinmao Tower

The two towers are neighbors and locate at the east bank of Huangpu River.

Two ways to get there:

(1) Take a taxi.

(2) Take taxi or BUS 765[1] to Zhongshan Park Station, then take Metro Line 2 to Lujiazui Station.

东方明珠和金茂大厦

东方明珠电视塔与金茂大厦位于黄浦江的东岸，两塔毗邻。

交通路线：

(1) 乘出租车直接前往。

(2) 乘出租车或者 765[1]路公交车到中山公园换乘轨道交通 2 号线到陆家嘴下车。

Century Park

It is a great and beautiful park located near Lujiazui at

世纪公园

浦东世纪公园位于浦东新区，公园内环境优美，有

Pudong.

Open time: 7 a.m.-6 p.m. everyday.

Common Ticket: 10 RMB Yuan (Additional service, such as boating, fishing, needs special fees.)

Two ways to get there:

(1) Take a taxi.

(2) Take taxi or BUS 765[1] to Zhongshan Park Station, then take Metro Line 2 to the Century Park Station.

“假日之园”的美誉。

开放时间：每天上午 7 点-下午 6 点。

普通票价：10 元（不包含划船、钓鱼等活动项目的费用）

交通路线：

(1) 乘出租车直接前往。

(2) 乘出租车或者 765[1]路公交车到中山公园换乘轨道交通 2 号线到世纪公园站下车。

Shopping

Nanjing Road

The 5.5-km long Nanjing Road is the most bustling and prosperous street in Shanghai.

Department store and supermarket:

(1) Westgate Mall (1038 West Nanjing Road)

(2) Citic square (1168 West Nanjing Road)

(3) Rafflescity (268 Middle Xizang Road)

Two ways to get there:

(1) Take a taxi;

(2) Take taxi or BUS 765[1] to Zhongshan Park Station, then take Metro Line 2 to People's Square Station.

南京路步行街

这个总长约 5.5 千米的步行街是上海最繁荣喧闹的地方。

百货商店和超市：

(1) 梅龙镇广场（南京西路 1038 号）

(2) 中信泰富（南京西路 1168 号）

(3) 来福士广场（西藏中路 268 号）

交通路线：

(1) 乘出租车直接前往。

(2) 乘出租车或者 765[1]路公交车到中山公园换乘轨道交通 2 号线到人民广场下车。

Huaihai Road

There are a lot of department stores and exclusive stores.

Two ways to get there:

(1) Take a taxi.

(2) Take taxi or BUS 765[1] to Zhongshan Park Station, then take Metro Line 2 to People's Square Station, then interchange Metro Line 1 to South Huangpi RD Station.

淮海路

汇集多种品牌专卖店和大型百货商店。

交通路线：

(1) 乘出租车直接前往。

(2) 乘出租车或者 765[1]路公交车到中山公园换乘轨道交通 2 号线到人民广场站转乘轨道交通 1 号线到黄陂南路站下车。

Xujiahui

There are a lot of department stores and exclusive stores.

Two ways to get there:

(1) Take a taxi.

(2)Take Metro Line 4 [2]to Shanghai Indoor Stadium Station, then interchange Metro Line 1 to Xujiahui Station.

(3) Take taxi or BUS 765[1] to Zhongshan Park Station,

徐家汇

汇集多种品牌专卖店和大型百货商店。

交通路线：

(1) 乘出租车直接前往。

(2) 乘轨道交通 4 号线[2]到上海体育馆换乘 1 号线到徐家汇站下车。

(3) 乘出租车或者 765[1]路公交车到中山公园换乘

then take BUS 946 to Jiao Tong University Station.

公交 946 到交通大学下车。

Lujiazui Commercial Center

Department store and supermarket:

(1) Super Brand Mall (168 West Lujiazui Road)

Two ways to get there:

(1) Take a taxi.

(2) Take taxi or BUS 765[1] to Zhongshan Park Station, then take Metro Line 2 to Lujiazui Station.

陆家嘴商业区

百货商店和超市：

(1) 正大广场（陆家嘴西路 168 号）

交通路线：

(1) 乘出租车直接前往。

(2) 乘出租车或者 765[1]路公交车到中山公园换乘轨道交通 2 号线到陆家嘴下车。

Zhongshan Park

Department store and supermarket:

(1) Cloud Nine Shopping Center (1018 Changning Road)

(2) Carrefour (B1-B2 Cloud Nine Shopping Center)

How to get there?

Take taxi or BUS 67 or 765[1] to Zhongshan Park

中山公园

百货商店和超市：

(1) 龙之梦购物中心（长宁路 1018 号）

(2) 家乐福超市（龙之梦购物中心 B1-B2 层）

交通路线：

乘出租车或者公交 67，765[1]路到中山公园站下车。

Restaurant

Hengshan Road

It is close to Xu Jiahui Commercial Circle, here there are many bars and restaurants. At night, Hengshan Road can be one of the most bustling places in Shanghai.

Restaurant and Address:

(1) TGI Friday (4 Hengshan Road, by South Wulumuqi Road)

(2) Anadolu Restaurant (4-7 Hengshan Road)

(3) Westside (237 Hengshan Road)

Two ways to get there:

(1) Take a taxi.

(2) Take taxi or BUS 765[1] to Zhongshan Park Station, then take Metro Line 2 to People's Square Station, then interchange Metro Line 1 to Hengshan RD Station.

衡山路

它毗邻徐家汇商业区，在这里有许多酒吧和餐馆。夜晚的衡山路是上海最喧闹繁华的街区之一。

餐馆及其地址：

(1) 星期五餐厅（衡山路 4 号，近乌鲁木齐路）

(2) Anadolu 餐厅（衡山路 4-7 号）

(3) 西界（衡山路 237 号）

交通路线：

(1) 乘出租车直接前往。

(2) 乘出租车或者 765[1]路公交车到中山公园换乘轨道交通 2 号线到人民广场站转乘轨道交通 1 号线到衡山路站下车。

Xin Tian Di

It is the most fashionable area cultivated in the distinctive Shikumen Buildings. Every building has a modern interior and has become an international gallery, fashion shop, restaurant, coffee house or bar.

新天地

它是生长在古老石库门中的现代流行地带。每一个石库门建筑的内部都充满了现代的气息，在那里有许多品牌服饰店，餐馆，咖啡吧和酒吧。

Restaurant and Address:

(1) LUNA (15 Lane 169 Taicang Road)

(2) Paradise (1F Building 5, Lane 123 Xingye Road)

(3) Butterfly Garden (70 Taicang Road)

(4) Bellagio Cuisine (68 Taicang Road)

Two ways to get there:

(1) Take a taxi.

(2) Take taxi or BUS 765[1] to Zhongshan Park Station, then take Metro Line 2 to People's Square Station, then interchange Metro Line 1 to South Huangpi RD Station.

餐馆及其地址：

(1) 璐娜（太仓路 169 弄 15 号）

(2) 乐园（兴业路 123 弄 5 号楼一楼 5 单元）

(3) 上海蝶园餐厅（太仓路 70 号）

(4) 鹿港小镇（太仓路 68 号）

交通路线：

(1) 乘出租车直接前往。

(2) 乘出租车或者 765[1]路公交车到中山公园换乘轨道交通 2 号线到人民广场站转乘轨道交通 1 号线到黄陂南路站下车。

Nanjing Road

Restaurant and Address:

(1) Yangzhou restaurant (345 Middle Fujian Road)

(2) Vegetarian Lifestyle (258 Fengxian Road)

(3) Papa John’s Pizza (B1 Rafflescity, 268 Middle Xizang Road)

南京路步行街

餐馆及其地址：

(1) 扬州饭店（福建中路 345 号）

(2) 枣子树（奉贤路 258 号）

(3) 棒约翰比萨（西藏中路 268 号来福士广场 B1 层）

The Bund

Restaurant and Address:

(1) Paulaner Brauhaus (2967 the Riverside Avenue)

(2) Gino (2F 66 East Nanjing Road)

(3) Element Fresh (1F Super Brand Mall 168 West Lujiaziu Road)

Two ways to get there:

(1) Take a taxi.

(2) Take taxi or BUS 765[1] to Zhongshan Park Station, then take Metro Line 2 to Lujiazui Station.

外滩（滨江大道）

餐馆及其地址：

(1) 宝莱纳餐厅（滨江大道 2967 号）

(2) 季诺餐厅（南京东路 66 号二楼）

(3) 新元素（陆家嘴西路 168 号正大广场一楼）

交通路线：

(1) 乘出租车直接前往。

(2) 乘出租车或者 765[1]路公交车到中山公园换乘轨道交通 2 号线到陆家嘴下车。

Yu Garden

Restaurant and Address:

(1) lu bo lang (115 Yuyuan Road)

(2) hu xin ting (257 Yuyuan Road)

(3) Old restautant of Shanghai (242 Fuyou Road)

豫园

餐馆及其地址：

(1) 绿波廊（豫园路 115 号）

(2) 湖心亭（豫园路 257 号）

(3) 上海老饭店（福佑路 242 号）

[1] BUS 765：near the front gate of ECNU

[2] Metro Line 4: at the crossing of Jinshajiang Road and Kaixuan Road

[1] 765 路公交车：在华师大前门附近

[2]轨道交通 4 号线：位于金沙江路凯旋路路口

Map of ECNU 华东师范大学简图

通往枣阳路校门
To the gate on the Zaoyang Road

共青路 Gongqing Road

丽娃河

中山北路 Northern Zhongshan Road

先锋路 Xianfeng Road

The Liwa River

宿 舍 路

Youyi Road

通往先锋路校门
To the gate on the Xianfeng Road

N

1.学校正门 Main Entrance of Campus
2.科学会堂 Science Hall
3.逸夫楼宾馆 YiFu Hotel
5.国际交流中心 International Exchange Service Center
6.毛主席像 Statue of Mao
7.理科大楼 Science Building
8.办公楼 University Administration Building