

2019 Workshop on Geometry and Nonlinear

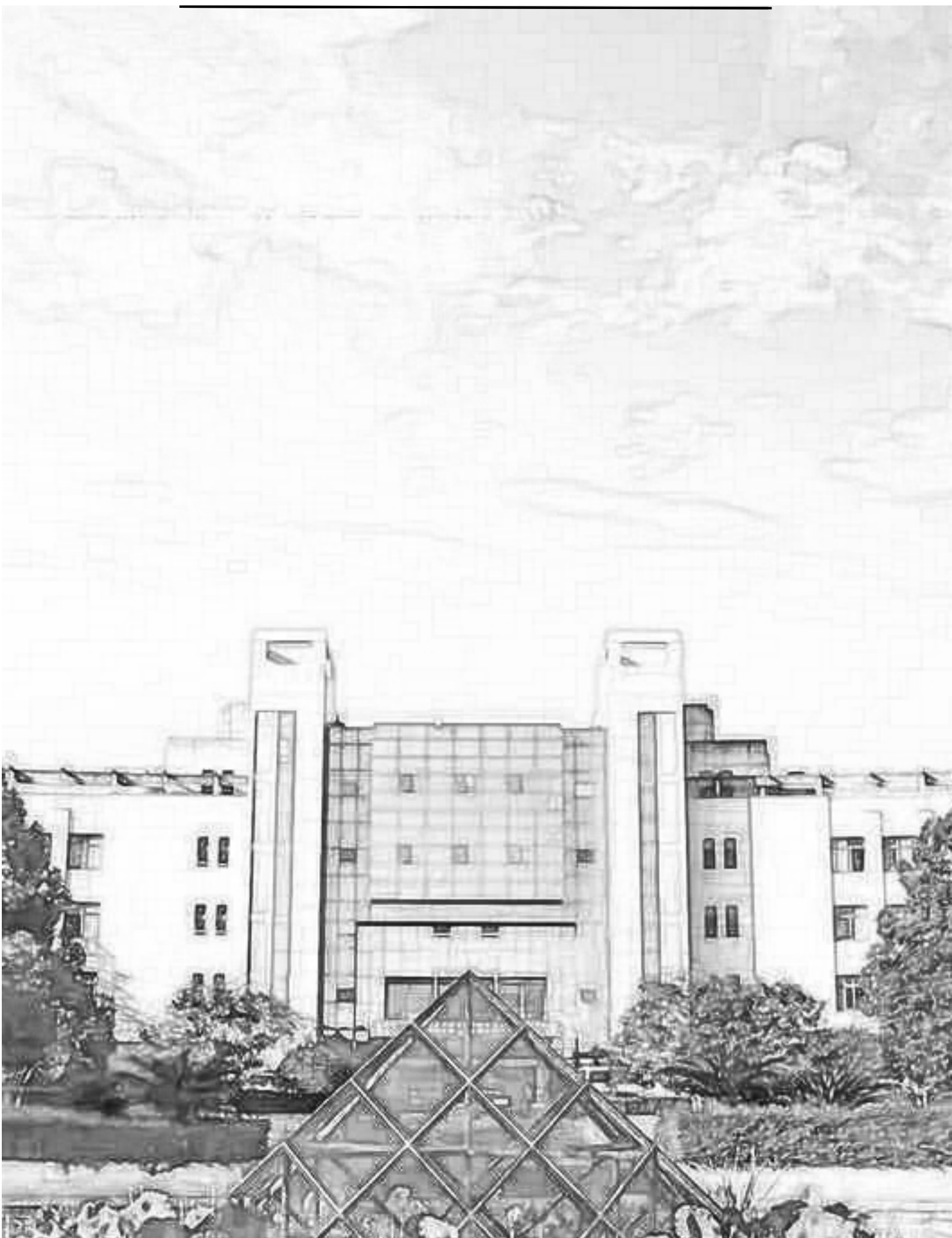
Partial Differential Equations

2019几何与非线性偏微分方程

学术研讨会程序册



丽水2019.11.22-24



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会议简介

1.1 会议主旨

为了交流近年来在几何与非线性偏微分方程领域所取得的最新研究成果，讨论相关的前沿课题，同时促进相关领域专家学者间的合作交流，丽水学院数学系和非线性分析研究所定于2019年11月22日至24日在丽水学院举办《2019几何与非线性偏微分方程学术研讨会》。在此，我们诚挚邀请您参加此次会议，热情期待您的莅临！

1.2 会议组织

·组织委员会：陈娅红 程丽 蒋红标 赖宁安 林银河 马正义 谢林森

1.3 会议地点及简要日程

会议地点：丽水学院东校区11B-203

报到地点：丽水市万廷大酒店

住宿地点：万廷大酒店

简要日程：

- 11月22日（周五）报到；
- 11月23日（周六）会议报告；
- 11月24日（周日）上午：会议报告；下午：自由讨论；
- 11月25日（周一）离会

1.4 主办单位简介

丽水学院数学系是丽水学院最早设置的学系之一，已有40多年的办学历史。现有数学与应用数学和信息与计算科学两个专业，其中数学与应用数学专业是浙江省重点建设专业；基础数学是浙江省重点学科；数学学科2016年被列入浙江省一流学科（B类）建设。

数学系拥有一支高素质的师资队伍，现有教师33人，其中教授9人，副教授15人，具有博士学位14人，其中5位博士分别在美国、德国和澳大利亚等国家具有海外至少一年的访学经历，有6位老师兼任浙江师范大学和浙江理工大学的硕士研究生导师，享受国务院特殊津贴1人，浙江省151人才3人，浙江省高校中青年学科带头人2人，丽水市138人才4人。



在人才培养方面注意学生的全面发展和创新能力的提高，积极组织学参加美国大学生数学建模竞赛、全国大学生数学建模竞赛、全国和浙江省高等数学竞赛。此外，在人才培养过程中充分的尊重学生个性化发展，在备大学一、二年级，主要培养学生的掌握数学科学的基本理论和基本方法，具备扎实的数学功底，形成良好的数学素养。在大学三、四年级，根据学生未来的志向和发展，通过开设不同方向的选修课，培养学生从事中小学数学教学，或从事金融、生产、管理等企事业单位的统筹优化、咨询、科技开发研究和管理工作，或通过继续攻读研究生，成为应用型、创新型和研究型人才。

近五年来，本专业毕业生的就业率平均在90%以上，学生对学校的满意度平均为86，用人单位的满意度平均达89。师范类毕业生取得教师资格证的比例平均为95%，此外，有69位同学考取了复旦大学、浙江大学、上海大学、上海对外经贸大学、华南师范大学、浙江师范大学、杭州师范大学等高校的硕士研究生。

1.5 致谢

本次会议主要由丽水学院数学系以及丽水学院非线性分析研究所支持举办。对参加会议的各位同行专家给予我们的鼎力支持，我们表示诚挚的谢意！

会议日程安排

11月23日 (周六) 上午			
时间	内容	主持人	地点
8:15-8:30	开幕式, 合影	赖宁安	11B-203
8:30-9:15	Hiroiyuki Takamura (Tohoku University) The lifespan of solutions of semilinear wave equations with the scale-invariant damping in two space dimensions	周忆	11B-203
9:15-10:00	王成波 (浙江大学) The blow up of solutions to semilinear wave equations on asymptotically Euclidean manifolds	周忆	11B-203
10:00-10:20 茶歇			
10:20-11:05	刘保平 (北京大学) Long time dynamics of small solutions to nonlinear charge transfer model	王成波	11B-203
11:05-11:50	丁冰冰 (南京师范大学) Global existence to Chaplygin gases with large data	王成波	11B-203
12:00午餐			

11月23日 (周六) 下午			
时间	内容	主持人	地点
14:00-14:45	谢纳庆 (复旦大学) On limit behavior of quasi-local mass for ellipsoids at spatial infinity	刘保平	11B-203
14:45-15:30	杨诗武 (北京国际数学研究中心) Decay properties for defocusing semilinear wave equations	刘保平	11B-203
15:30-15:50 茶歇			
15:50-16:35	吴小宁 (中国科学院数学与系统科学研究院) Mixed boundary value problem of linear wave equations in asymptotic AdS space-time	杨诗武	11B-203
16:35-17:20	Nico Michele Schiavone (Sapienza University of Rome) Heat-like and wave-like behaviour of the lifespan estimates for wave equations with scale-invariant damping and mass	杨诗武	11B-203
17:20-18:05	Masahiro Ikeda (RIKEN and Keio University) Test function method for blow-up phenomena of semilinear wave equations and their weakly coupled systems	杨诗武	11B-203
18:10晚餐			

11月24日 (周日) 上午			
时间	内容	主持人	地点
8:30-9:15	缪爽 (武汉大学) Tidal energy in Newtonian two-body motion	Hiroyuki Takamura	11B-203
9:15-10:00	魏昌华 (浙江理工大学) Recent results on relativistic Euler equations with a linearly degenerate equation of state	Hiroyuki Takamura	11B-203
10:00-10:20 茶歇			
10:20-11:05	何道垠 (复旦大学) Long time behavior of semilinear Tricomi equations	缪爽	11B-203
11:05-11:50	金云娟 (华东师范大学) Hypersonic-limit flow passing bodies and Radon measure solutions of hyperbolic conservation laws	缪爽	11B-203
11:40-12:25	Tomoyuki Tanaka (RIKEN AIPcenter/Nagoya University/Keio University/Chuo University) Global well-posedness for the wave equation with a time-dependent scale invariant damping and a cubic convolution	缪爽	11B-203
12:25-12:35	会议闭幕式		
12:40 午餐			
14:00-18:00 自由讨论			

会议报告简介

Global existence to Chaplygin gases with large data

丁冰冰 (南京师范大学)

In this talk, we are concerned with the global existence of solutions to 3D Euler systems of Chaplygin gases with large data. As a first step of study, we assume that the gases are isentropic and irrotational, and the data we choose are those “short pulse data” which were first introduced by D. Christodoulou when he studied the formation of black holes in General Relativity.

Long Time Behavior of Semilinear Tricomi Equations

何道垠 (复旦大学)

In this talk, we are concerned with the global Cauchy problem for the semilinear generalized Tricomi equation $\partial_t^2 u - t^m \Delta u = |u|^p$ with initial data

$$(u(0, \cdot), \partial_t u(0, \cdot)) = (u_0, u_1),$$

where $t \geq 0$, $x \in \mathbb{R}^n$ ($n \geq 1$), $m \in \mathbb{Z}$, $p > 1$, and $u_i \in C_0^\infty(\mathbb{R}^n)$ ($i = 0, 1$).

We show that there exists a critical exponent $p_{crit}(m, n) > 1$ such that the solution u , in general, blows up in finite time when $1 < p \leq p_{crit}(m, n)$. We further show that for the case $p > p_{crit}(m, n)$ the solution u exists globally provided that the initial data is small enough. This result is a generalization of the Strauss's conjecture in degenerate wave equations.

Test function method for blow-up phenomena of semilinear wave equations and their weakly coupled systems

Masahiro Ikeda (RIKEN and Keio University)

In this talk we consider the wave equations with power type nonlinearities including time-derivatives of unknown functions and their weakly coupled systems. We propose a framework of test function method and give a simple proof of the derivation of sharp upper bound of lifespan of solutions to nonlinear wave equations and their systems. We point out that for respective critical case, we use a family of self-similar solution to the standard wave equation including Gauss's hypergeometric functions which are originally introduced by Zhou (1992). However, our framework is much simpler than that. As a consequence, we found new (p, q) -curve for the system $\partial_t^2 u - \Delta u = |v|^q$, $\partial_t^2 v - \Delta v = |u|^p$ and lifespan estimate for small solutions for new region.

Hypersonic-limit flow passing bodies and Radon measure solutions of hyperbolic conservation laws

金云娟 (华东师范大学)

We consider two-dimensional steady non-isentropic compressible hypersonic-limit Euler flow passing bodies. We propose a rigorous definition of Radon measure solution to study the boundary problem of hypersonic-limit flow and obtain Radon measure solutions for three typical problems. We recovered the Newton-Busseman formula of drags\lifts of hypersonic-limit flow past a ramp. In the case of given pressure of still gas behind a finite ramp, we discover the shape of the free layer (δ -shock) is different for different pressure of downstream gas and the measure solution may blow up for large back pressure. We also study the interaction of elementary waves with the free layer. Moreover, the research shows the necessity of studying singular Riemann problem of hyperbolic conservation system with discontinuous fluxes. The talk is based on the joint work with Prof. Hairong Yuan and Prof. Aifang Qu.

Long time dynamics of small solutions to nonlinear charge transfer model

刘保平 (北京大学)

We analyze the long-time behaviors of small solutions to the nonlinear Schrodinger equation (NLS) with multiple moving potentials in the energy space. We show that for large time, the solution will decompose into the sum of small solitary waves associated with each potential and a radiation term, which will scatter to a free wave.

Tidal energy in Newtonian two-body motion

缪爽 (武汉大学)

In this work, which is based on an essential linear analysis by Christodoulou, we study the tidal energy for the motion of two gravitating incompressible fluid balls with free boundaries, obeying the Euler-Poisson equations. The orbital energy is defined as the mechanical energy of the center of mass of the two bodies. When the fluids are replaced by point masses, according to the classical analysis of Kepler and Newton, the conic curve describing the trajectories of the bodies is a hyperbola when the orbital energy is positive and an ellipse when the orbital energy is negative. If the point masses are initially very far, then the orbital energy, which is conserved in the case of point masses, is positive corresponding to hyperbolic motion. However, in the motion of fluid balls the orbital energy is no longer conserved, as part of the conserved energy is used in deforming the boundaries of the bodies. This energy is called the tidal energy. If the tidal energy becomes larger than the total energy during the evolution, the orbital energy must change its sign, signaling a qualitative change in the orbit of the bodies. We will show that under appropriate conditions on the initial configuration this change of sign occurs. Our analysis relies on an a-priori estimates which we establish up to the point of closest approach. This is a joint work with Sohrab Shahshahani.

Heat-like and wave-like behaviour of the lifespan estimates for wave equations with scale-invariant damping and mass

Nico Michele Schiavone (Sapienza University of Rome)

In this talk we consider blow-up results and lifespan estimates in the subcritical-case for wave equations with scale-invariant damping and mass and power-nonlinearity. The focus of this talk is to show how the competition between the ‘heat-like’ and ‘wave like’ behaviours appears not only in the definition of the critical exponent, but also in the lifespan estimates, which transit from one behaviour to the other in dependence of the damping and mass coefficients and in dependence of the exponent in the nonlinearity. Moreover, we see that the lifespan estimates can be different also under certain conditions on the initial data. This work is in collaboration with Ning-An Lai (Lishui University) and Hiroyuki Takamura (Tohoku University).

**The lifespan of solutions of semilinear wave equations with
the scale-invariant damping in two space dimensions**

Hiroyuki Takamura (Tohoku University)

In this talk, I will discuss about the initial value problem for semilinear wave equations with the time-dependent and scale-invariant damping in two dimensions. Similarly to the one dimensional case by Kato, Takamura and Wakasa in DIE(2019), we obtain the lifespan estimates of the solution for a special constant in the damping term, which are classified by total integral of the sum of the initial position and speed. The key fact is that, only in two space dimensions, such a special constant in the damping term is a threshold between "wave-like" domain and "heat-like" domain. As a result, we obtain a new type of estimate especially for the critical exponent. The main result is a joint work with T.Imai, M.Kato and K.Wakasa.

**Global well-posedness for the wave equation with a time-dependent scale
invariant damping and a cubic convolution**

Tomoyuki Tanaka

(RIKEN AIP center/Nagoya University/Keio University/Chuo University)

In this talk, we consider global well-posedness for the wave equation with a time-dependent scale invariant damping, i.e., $\frac{2}{1+t}u$ and a cubic convolution $(|x|^{-\gamma} * u^2)u$, where $0 < \gamma < n$. For a power type nonlinearity, the work of D’Abicco, Lucente and Reissig shows that a critical exponent, which divides global existence and blow-up for small solutions, is shifted because of the presence of the damping term. Our aim of this work is to determine two types of critical exponents of the problem with the cubic convolution. The one is for compactly supported initial data. The second is a critical exponent about the spatial decay condition on the data. This talk is based on a joint work with Masahiro Ikeda (RIKEN/Keio) and Kyouhei Wakasa (Kushiro).

**The blow up of solutions to semilinear wave equations
on asymptotically Euclidean manifolds**

王成波 (浙江大学)

In this talk, I will talk about our recent work on the problem of blow up and lifespan estimates for the solutions to the semilinear wave equations, posed on asymptotically Euclidean manifolds. Here the metric is assumed to be exponential perturbation of the spherical symmetric, long range asymptotically Euclidean metric. In addition, our argument works equally well for semilinear damped wave equations, when the coefficient of the dissipation term is space-independent and integrable (without sign condition). It is joint work with Mengyun Liu.

**Recent results on relativistic Euler equations with
a linearly degenerate equation of state**

魏昌华 (浙江理工大学)

In this report, we introduce the global radial solutions of non-isentropic relativistic Euler equations with a linearly degenerate equation of state (Chaplygin gas and Stiff matter). We mainly give the main idea of how to get the global existence results of 2D case. This is a joint work with Prof. Zhen Lei.

**Mixed boundary value problem of linear wave equations
in asymptotic AdS space-time**

吴小宁 (中国科学院数学与系统科学研究院)

We consider the existence of global solution of linear wave equation in general asymptotic AdS space-time with boundary data on a time-like and null hypersurfaces. With the help of energy estimates, we prove the global solution will be unique determined by the data on above boundary and data on conformal infinity boundary. This result may help us to get better understanding on AdS/CFT and related topic.

On limit behavior of quasi-local mass for ellipsoids at spatial infinity

谢纳庆 (复旦大学)

We discuss the spatial limit of the quasi-local mass for certain ellipsoids in an asymptotically flat static spherically symmetric spacetime. These ellipsoids are not nearly round but they are of interest as an admissible parametrized foliation defining the Arnowitt-Deser-Misner (ADM) mass. The Hawking mass of this family of ellipsoids tends to $-\infty$. In contrast, we show that the Hayward mass converges to a finite value. Moreover, a positive mass type theorem is established. The limit of the mass has a uniform positive lower bound no matter how oblate these ellipsoids are. This result could be extended for asymptotically Schwarzschild manifolds. This talk is based on a joint work with Xiaokai He and Leong-Fai Wong.

Decay properties for defocusing semilinear wave equations

杨诗武 (北京国际数学研究中心)

In this talk, I will present recent progress on the asymptotic decay properties for energy subcritical defocusing semilinear wave equations. For certain range of the power p , containing part of subconformal class, the solution scatters in the critical Sobolev space and energy space in space dimension greater than 2. In addition, in

space dimension 3, the solution also verifies pointwise decay properties.

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(按姓氏排列)

附录：交通信息、联系方式及其他

A.1 交通信息

受条件所限，我们无法安排车辆接各位老师抵达会场，还请各位谅解！请您自行搭乘公交或出租车抵达会议报到地点：丽水市万廷大酒店。以下是相关的交通信息，如果有不清楚的地方，还请大家随时联系我们。

- (公交) 丽水站 (高铁站) - 万廷大酒店

高铁站上车，乘坐公交4路/K4路或203路/K203路，在天宁寺行政村下车即可（行程约33分钟）；

注：公交车花费1.5元，现金或打开支付宝-付钱码（不是乘车码）

- (出租车) 丽水站 (高铁站) - 万廷大酒店

高铁站上车，行程约4.3公里，价格为16元左右，大约需要20分钟。

A.2 友情提示

根据天气预报数据，预计丽水气温会在15-22℃左右，多云转雨。请您根据需要准备合适衣物及带好雨伞。

A.3 联系方式

·赖宁安

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如果有任何需要帮助的地方, 请您随时联系我们。

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11B203



丽水学院数学系

Department of Mathematics,
Lishui University

会议通知

为了交流近年来在几何与非线性偏微分方程领域所取得的最新研究成果，讨论相关的前沿课题，同时促进几何与非线性偏微分方程相关领域专家学者间的合作交流，丽水学院数学系和非线性分析研究所定于2019年11月23日至24日在丽水学院举行《2019几何与非线性偏微分方程学术研讨会》。在此，我们诚挚邀请您参加此次会议，热情期待您的莅临！

本次活动的交通费及住宿费自理，不收取会务费。

组织委员会：

陈娅红 程丽 蒋红标 赖宁安 林银河 马正义 谢林森

会议时间与地点：

2019年11月23日-2019年11月24日

主办单位：

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2019年10月30日

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