

Curriculum Vitae Yuan(Friedrich) Qiu Math & CS @Williams '24 NSF RIPS-UCLA' 23 CEE RSI-MIT'18 Ross Math-Ohio Uni'18		Email: yuanqiu2019@gmail.com Telephone: +86 18701683988 GitHub: friedrichq@163.com	
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RESEARCH INTERESTS

Number Theory, Algebra, Combinatorics, Analysis, Theoretical Computer Science, Algorithms, Computational Complexity Theory, Quantum Algorithms, Quantum Computing.

EDUCATION

Williams College <i>B.A. in Mathematics and Computer Science (Honors)</i> <i>Honors Thesis: Greedy and Speedy: New Iterative Gray Code Algorithms for Generating Signed Permutations</i> <i>Advisor: Professor Aaron Williams</i>	Williamstown, MA, USA June 2024
Study Abroad at the Math in Moscow Program/HSE University (Remote) <i>Graduate level of math courses and Research</i>	Moscow, Russia Spring 2025, Fall 2024, Fall 2023, Fall 2022
Study Abroad at the Budapest Semesters in Mathematics Program <i>Concentration on Pure Mathematics</i>	Budapest, Hungary Spring 2022
University of California, Berkeley <i>Berkeley Summer Session</i>	Berkeley, USA Summer 2022
MIT Schwarzman College of Computing (Remote) <i>Certificate in Applied Data Science</i>	Cambridge, USA Spring 2023

Major GPA / Mathematics and Computer Science: 3.82/4.0; Cum. GPA: 3.58/4.0

[View Coursework](#)

GRE Test

- ◆ GRE Math Subject: 930/990, 95% (*Paper-Delivered Test, September 17, 2022*)
- ◆ GRE General: 333; Q 170/170, V 163/170 (*On-Site Test, June 27, 2021*)

PUBLICATIONS / PRESENTATIONS / POSTERS- [VIEW GOOGLE SCHOLAR](#)

- ◆ [Yuan Qiu](#)¹, Alexander Kalmynin¹, Omega Theorem for Fractional Sigma Function, arXiv: 2412.00723, December 1, 2024.
<https://arxiv.org/abs/2412.00723> [View Math Paper 3-PDF](#)
- ◆ Liyang Shen, Hùng Việt Chu, Kevin Huule, Steven J. Miller, [Yuan Qiu](#), *Linear Recurrences of Order at Most Two in Nontrivial Small Divisors and Large Divisors*, arXiv: 2210.00363, Combinatorial and Additive Number Theory (CANT) 2023, May 23-26, 2023, to appear in the Proceedings of Combinatorial and Additive Number Theory VI, Jan 2025.

<https://theoryofnumbers.com/cant/> <https://arxiv.org/abs/2210.00363> **View Math Paper 2-PDF**

♦ **Yuan Qiu**¹, Eric Grinberg¹, *Exploring Admissible Complexes of the Radon Transform over Finite Field*, S.-T. Yau High School Science Award in Mathematics, November 1-7, 2018 (Oral); CEE Research Science Institute Symposium-M.I.T (Oral).

<http://www.yau-awards.com/> **View Math Paper 1-PDF**

♦ Sudatta Hor¹, Ellen Chlachidze¹, Triet Ha¹, **Yuan Qiu**¹, *Expressibility of Quantum Circuits for Chemistry Applications*, presented at JMM 2024, January 3-6, 2024 (Poster).

<https://meetings.ams.org/math/jmm2024/meetingapp.cgi/Paper/28449> **View QC Poster-PDF**

♦ **Yuan Qiu**¹, Aaron Williams¹, *Generating Signed Permutations by Twisting Two-Sided Ribbons*, arXiv: 2311.06974v2 [cs.DS] 14 Jun 2024, Proceedings of LATIN 2024: Theoretical Informatics, 14-129, Part I, Springer; Presented at the 16th Latin American Symposium, Puerto Varas, Chile, March 18-22, 2024 (Oral).

<https://link.springer.com/book/10.1007/978-3-031-55598-5> <https://arxiv.org/abs/2311.06974> **CS Paper1-PDF**

♦ **Yuan Qiu**¹, Joe Sawada², Aaron Williams¹, *Maximize the Rightmost Digit: Gray Codes for Restricted Growth Strings*, to appear at the 19th International Conference and Workshops on Algorithms and Computation, February 28 - March 2, 2025 (Oral)

<https://tcsuestc.com/walcom2025/pages/accepted.html> **View CS Paper 2-PDF**

♦ **Yuan Qiu**¹, Aaron Williams, *Greedy and Speedy: New Iterative Gray Code Algorithms for Generating Signed Permutations*, Honors Thesis Proposal Colloquium at the Department of Computer Science, Williams College, February 2024 (Oral).

View CS Honors Thesis-PDF **View Research Proposal-PDF**

♦ **Yuan Qiu**¹, Sudatta Hor¹, Ellen Chlachidze¹, Triet Ha¹, *Benchmarking Quantum Chemistry Circuit Costs for Near Term Quantum Computers*, A 64-Page Research Report presented at the IBM Quantum Group Workshop in Almaden and the UCLA IPAM RIPS Project Day, August 2023 (Oral).

♦ **Yuan Qiu**, *Exploring Properties of Twin Primes and Brun's Theorem*, Mathematics Colloquium at the Department of Mathematics and Statistics, Williams College, February 19, 2024 (Oral).

RESEARCH INTERNSHIPS

Omega Theorem for Fractional Sigma Function.

May 2024-Present

Advisor: Prof. Dr. Alexander Kalmynin

National Research University Higher School of Economics

- ♦ An independent research in analytic number theory with Prof. Kalmynin from HSE University (Remote). Work on the summation of fractional divisor-sum functions by applying the functional equation for L-functions, Cauchy's residue theorem and shifting the contour of complex integration. Formulate the residue as an infinite sum of Gamma function, which was later transformed into summation of Bessel functions and modified Bessel functions.
- ♦ Study a truncated version of our infinite integral through Perron's formula, with the aim of approximating the infinite integral. Transform the linear combination of Bessel functions into a summation of trigonometric functions through asymptotic formulas. Apply Soundararajan's Lemma on the summation for deriving an adequate lower bound.
- ♦ 40 hours per week; 24 weeks per year.

Irregularities in Distribution of Pythagorean Triples

Sept. 2023-Dec. 2023

Advisor: Prof. Dr. Alexander Kalmynin

National Research University Higher School of Economics

- ♦ An independent number theory research on Irregularities in Distribution of Pythagorean Triples under the guidance of Prof. Alexander Kalmynin from HSE University (Remote).
- ♦ Worked on the fluctuations of the asymptotic formula for counting Pythagorean triples with the largest term less than a given magnitude x .
- ♦ Focused on some logarithmic improvements on the known bound of error term $\Omega(x^{1/3})$ using Voronoi-type summation formulas and modern strategies of obtaining lower bounds for oscillating sums.
- ♦ 10 hours per week; 15 weeks per year.

Polymath Research Experience for Undergraduates (REU) in Number Theory

Summer 2022

Advisor: Prof. Dr. Steven Miller

Williams College

- ◆ Continued my Polymath REU to conduct number theory research on Linear Recurrences of Order at Most Two in Nontrivial Small Divisors and Large Divisors (partially supported by NSF award) supervised by Prof. Steven Miller from Williams College.
- ◆ Examined the patterns of linear recurrence of order at most two among the divisor sets of any given integers. Used programming to help discover patterns and exclude certain configurations through algorithms.
- ◆ Determined the range, configuration and asymptotic counts for these numbers with case analysis in both large divisor set and small divisor set.
- ◆ 20 hours per week; 10 weeks per year.

Polymath Research Experience for Undergraduates (REU) in Number Theory

Summer 2021

Advisor: Prof. Dr. Steven Miller

Williams College

- ◆ Selected to the Polymath REU to conduct number theory research (partially supported by NSF award) with a PhD., two undergrads supervised by Prof. Steven Miller from Williams College.
- ◆ Explored avoiding 3-term geometric progressions in non-commutative settings. Studied the problem in two different settings, namely on quaternions and free groups and analyzed possible results on the largest sets of integers that do not contain geometric sequences.
- ◆ Enumerated all possible configurations of integers that have divisor sets with such recurrence, and examined possible schemes for generating these integers.
- ◆ 20 hours per week; 8 weeks per year.

Benchmarking Quantum Chemistry Circuit Costs for Near Term Quantum Computers

Summer 2023

RIPS REU Funded by NSF and IBM

UCLA Institute for Pure and Applied Mathematics

Advisor: Dr. Scott Smart, Dr. Ieva Liepuoniute, Dr. Bibek Pokharel, Dr. Mirko Amico UCLA and IBM Quantum, Almaden

- ◆ Was one of 4 selected quantum computing group members (1% acceptance rate 36/3000+) at the UCLA IPAM Research in Industrial Projects for Students REU program funded by NSF and IBM Quantum. Worked with 3 undergraduates to focus on Quantum Computing for chemistry, specifically benchmarking quantum chemistry circuits on quantum simulators under the guidance and support of Dr. Scott Smart (Narang Lab, UCLA), Dr. Ieva Liepuoniute (IBM Quantum), Dr. Bibek Pokharel (IBM Quantum), Dr. Mirko Amico (IBM Quantum).
- ◆ Set benchmarks for application-specific metrics to evaluate the efficiency and applicability of the near-term quantum computers. Evaluated the computational cost of executing various quantum chemistry circuits in relation to the topology of IBMQ quantum device connections, type of native entangling interactions, and noise overhead.
- ◆ Analyzed the effect of adding repeating layers on the expressibility of parametrized quantum circuits for both hardware-efficient and chemistry-inspired circuits. Experimented on the effect under both ideal and noisy conditions, and extend the result on more qubits and higher circuit depth with supercomputer executions.
- ◆ Proposed a new metrics that is more representative of chemistry applications and examine its correlation with the performance of quantum chemistry.
- ◆ Completed a 64-page co-first-authored research report on Benchmarking Quantum Chemistry Circuit Costs for Near Term Quantum Computers. Presented research at the IBM Quantum Group Symposium in Almaden and the IPAM RIPS Symposium at UCLA.
- ◆ 50 hours per week; 9 weeks per year.

Low Noisy-Clean Coupling Quantum Compiler for Partially Error-Corrected Hardware

Aug.2024-Present

Advisor: Zhixin Song, Zhiding Liang

Rensselaer Polytechnic Institute

- ◆ Work as a research assistant with Profs. Zhixin and Zhiding to develop a novel compiler for partially error-corrected quantum hardware where few logical qubits and many physical qubits coexist. The compiler design reduces the noisy coupling between noisy and clean qubits, where the fidelity will be worse than the full QEC case but would allow executing a larger problem size.
- ◆ Further consider reducing the cost of running single-qubit analog rotation gates instead of injecting magic states.

- ◆ 20 hours per week; 32 weeks per year.

Maximize the Rightmost Digit: Gray Codes for Restricted Growth Strings

Oct. 2023-Present

Advisor: Prof. Dr. Aaron Williams

Williams College

- ◆ Independent Research on Maximize the Rightmost Digit: Gray Codes for Restricted Growth Strings with Prof. Dr. Aaron Williams from the Computer Science Department of Williams College.
- ◆ Develop effective constant amortized time (CAT) and loopless algorithms for generating Bell and k-Catalan counting strings from a universal mixed-radix string generator.
- ◆ Derive unprecedented bijection between pre-order traversal of k-ary trees and k-Catalan counting strings.
- ◆ Research on extension of bijection between set partition and Bell counting strings to k-Bell counting strings.
- ◆ 10 hours per week; 30 weeks per year.

Generating Signed Permutations by Twisting Two-Sided Ribbons

Apr. 2023-Dec. 2023

Advisor: Prof. Dr. Aaron Williams

Williams College

- ◆ Independent research on Generating Signed Permutations by Twisting Two-Sided Ribbons with Prof. Dr. Aaron Williams from the Computer Science Department of Williams College.
- ◆ Developed efficient programs for generating Gray codes for several types of sequences with a large variety of rulesets. Rediscovered classical Gray codes from Steinhaus-Johnson-Trotter algorithm using greedy algorithm, recursive programming and sequence-based algorithms.
- ◆ Extended search for Gray codes in the unlearned field of signed permutations. Generated all possible grey code configurations of signed permutation of integers using loopless algorithm with linear time complexity from extremely simple programs.
- ◆ 10 hours per week; 24 weeks per year.

Greedy and Speedy: New Gray Code Algorithms for Generating Signed Permutations

Sept. 2023-Present

Advisor: Prof. Dr. Aaron Williams

Williams College

- ◆ Honors thesis on Greedy and Speedy: New Gray Code Algorithms for Generating Signed Permutations supervised by Prof. Dr. Aaron Williams from the Computer Science Department of Williams College.
- ◆ Summarized and designed constant amortized time (CAT) and loopless algorithms for both signed permutations and restricted growth strings. Constructed proofs for validity of all greedy Gray codes for signed permutation and their corresponding generating rulesets.
- ◆ Developed novel Gray codes for spanning trees of complete graphs based on greedy basis-exchange algorithm of matroids with impressive features, which provides an elegant solution to one of Don Knuth's unsolved open problems. Investigating other types of graphs, including bipartite graph and grid graphs, to develop another solution.
- ◆ 10 hours per week; 30 weeks per year.

Exploring Properties of Twin Primes and Brun's Theorem

Sep.2023-Feb.2024

Advisor: Prof. Dr. Steven Miller

Williams College

- ◆ Explored properties of twin primes, which are primes differing by two. Discussed infinity of primes and distribution of primes, leading to the natural (and still unsolved) question on whether or not there are infinitely many twin primes.
- ◆ Presented Brun's Theorem, which states that the sum of the reciprocals of the twin primes converges; As the sum of the reciprocals of the primes diverges, this implies that even if there are infinitely many twin primes, their density is much less than that of the primes.
- ◆ Showed that Brun's Theorem is a consequence of determining a sufficiently good upper bound on the number of twin primes at most x , and sketch the inclusion-exclusion argument behind the proof.
- ◆ Talk on the mathematics colloquium at Williams College.
- ◆ 10 hours per week; 15 weeks per year.

Machine Learning and Deep Learning Algorithm Model in Business Decision

Jan. 2023-Apr. 2023

Advisor: Profs. Munther Dahleh and Bhaskar Pant

Massachusetts Institute of Technology

- ◆ Certificate in Applied Data Science from MIT Schwarzman College of Computing.

- ♦ Examined the features of diabetes among the Pima Indian tribe with exploratory data analysis, descriptive statistics and Python. Researched on the significance of correlation between occurrence of diabetes and factors such as pregnancy, skin thickness and BMI.
- ♦ Created a Deep Learning model that is able to recognize street view housing number digits, which can be used to improve quality of location recognition on map apps. Applied both Artificial Neural Network (ANN) and Convolutional Neural Network (CNN) blocks in the model and produced industry-level accuracy to the task.
- ♦ Built a computer vision model that distinguishes between different emotions on over 20,000 images of facial emotions with the aim to enhance the experience of human-AI interaction. Implemented a sophisticated model consisting of a large variety of neural network layers, which yielded significantly stronger results than popular neural network structures including VGG16, ResNet2 and EfficientNet.
- ♦ 10 hours per week; 12 weeks per year.

RSI Scholar: Exploring Admissible Complexes of the Radon Transform over Finite Field Summer 2018

Advisor: Prof. Dr. Eric Grinberg

CEE Research Science Institute at M.I.T

- ♦ Was one of 80+ top STEM talents from around the world (3% acceptance rate) at the Center for Excellence in Education (CEE) Research Science Institute (RSI) at M.I.T. Completed independently a graduate-level thesis under the guidance of Prof. Dr. Eric Grinberg.
- ♦ Explored variety of Plane Radon transform; Developed the Bolker condition as a tool to verify the invertibility of Radon transform. Discussed the invertibility of the transform in these finite geometries and used computer force and casework to calculate the number of collections of measurement objects (planes and lines). Calculated the number of Admissible Complexes in unit cube and hypercube.
- ♦ Presented my research at the Research Science Institute Symposium-M.I.T.
- ♦ Invited to present my research at the S.-T. Yau High School Science Award (Second Prize in Mathematics).
- ♦ 60 hours per week; 6 weeks per year.

Ross Math Summer Camp Participant: Number Theory

Summer 2018

Advisor: Prof. Dr. Daniel Shapiro

Ohio State University

- ♦ Was one of 60+ from around the world at the Ross Math Camp in the USA.
- ♦ Attended lectures and courses on Bernoulli Number and Zeta Function, Number Theory, Abstract Algebra; attended sessions, group meetings for the discussion. Worked on intensive problems in the field of number theory and math proofs with professors and peers.
- ♦ Left Ross camp and went to RSI at MIT in two weeks with the permission of Professor Daniel Shapiro due to the conflict of time. Continued and completed problem sets in three months.

HONORS AND AWARDS

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|---------------------------------------------------------------------------------------------------------------------------|------------------------|
| ♦ William Lowell Putnam Mathematics Competition | 2023, 2022, 2021, 2019 |
| <i>Roughly Top 7%, Team Leader</i> | |
| ♦ USA Mathematical Olympiad (USAMO) Qualifier (x 3) | 2018-2016 |
| <i>Roughly Top 20 Worldwide, Top 1 in China</i> | |
| ♦ Witte Problem Solving Prize at Williams | 2024 |
| ♦ Honors in Computer Science | 2024 |
| ♦ Membership in Sigma Xi, LATIN, WALCOM, JMM, MAA | 2024 |
| ♦ Williams College Award | 2024-2019 |
| <i>Annually USD 86,000</i> | |
| ♦ Dean's List (x 6) | Spring 2024-Fall 2020 |
| ♦ National Olympiad in Informatics in Provinces (NOIP-China) | 2017-2015 |
| <i>First Prize (x 3), Accepted to Winter Camp (x 3)</i> | |
| ♦ Harvard-MIT Math Tournament in February | 2018, 2017 |
| <i>Placed 9th Individual in Geometry, 23rd individual in Algebra and Number Theory, Team Leader</i> | |
| ♦ S.-T. Yau High School Science Award | 2018 |
| <i>Second Prize in Mathematics</i> | |

♦ American Regions Mathematics League (ARML) <i>Placed 1st Internationally, Team Leader</i>	2017
♦ United Kingdom Chemistry Olympiad <i>Placed 14th Internationally</i>	2018
♦ USA Chemistry Olympiad <i>Placed 30th Internationally</i>	2018
♦ British Physics Olympiad <i>Placed 23rd Internationally</i>	2018
♦ National Linguistics Olympiad (China) <i>First Prize</i>	2018

TEACHING EXPERIENCE

Williams College	Spring 2024
♦ TA for CSCI 361-Theory of Computation instructed by Prof. Dr. Aaron Williams at Williams College in Spring 2024.	
♦ Tutored 30+ students in TC, leading group sessions to deepen their understanding of TC concepts. Created tailored teaching materials for each student, concentrating on tackling their unique challenges in the classroom, such as simplifying NP-hard problems, distinguishing between NP-complete and PSPACE-complete, and more. Offered assistance with homework and exam preparation.	
♦ Attend department meetings and report on students' progress.	
♦ 5 hours per week; 15 weeks per year.	

Williams College	Fall 2023
♦ TA for MATH 150-Multivariable Calculus instructed by Prof. Dr. Stewart Johnson at Williams College in fall 2023.	
♦ Collaborated closely with professor to devise suitable teaching methods and skills. Offered personalized and group assistance to students in Multivariable Calculus, aiding them in mastering complex mathematical concepts, including intricate integration techniques. Created tailored teaching materials for each student, concentrating on tackling their unique challenges in the classroom. Provided guidance on assignments and projects during office hours, and graded homework and exams.	
♦ Monitored and assessed student performance.	
♦ 5 hours per week; 15 weeks per year.	

TECHNICAL SKILLS

Programming• 12 yrs experience	C/C++(fluent), Python(fluent), Qiskit(fluent), MatLab(fluent), LaTeX(fluent), Neural Network, Mathematica, Java, Stata, Go, HTML, CSS, Rust, R, Swift, SQL, LUA
Software&Tool	OpenMPI, Git, PyTorch, Hadoop, TensorFlow, NumPy, Keras, SciPy, Pandas, Matplotlib
Computational Techniques	Quantum Computing, Quantum Algorithms, Quantum Mechanics, Quantum Chemistry, Quantum Physics, Monte Carlo, ODE, PDE, Machine Learning, Deep Learning, NLP, Econometrics
Languages	English, <i>fluent</i> ; Chinese, <i>native</i> ; German, Basic

STUDY ABROAD EXPERIENCES

Budapest Semesters in Mathematics (BSM) Program	Jan. 2022-May 2022
♦ Enrolled in graduate-level pure mathematics courses at the BSM program and enjoyed creative problem solving and the excitement of mathematical discovery.	

- ◆ Participated regularly in the discussion and seminars on Combinatorics, Graph Theory, etc. The seminar on recent development in graph limits given by Abel Laureates Laszlo Lovasz at BSM greatly broadened my horizons.
- ◆ Found my strong research interest and passion for Quantum Computing and Quantum Algorithms through the study and discussion of quantum bits and quantum computers, complexity and quantum complexity, the algorithm for a quantum computer, Grover's search algorithm, and Shor's algorithm for factorizing numbers.

Math in Moscow (MiM) Program (Online Courses in Pure Math)

Fall 2022, Fall 2023

- ◆ Focus on graduate-level courses. Attend group discussions on Homology and Cohomology, Representation theory, Riemann Surfaces, Modular Forms, Introduction to Commutative and Homological Algebra, Differential Geometry, Dynamical Systems with professors and peers.
- ◆ Work independently on number theory research with Prof. Alexander Kalmynin.
- ◆ Enjoy interactive, in-depth teaching and discussion of pure math with mathematically motivated students.

CAREER EXPERIENCE

Discover Citadel & Citadel Securities, USA

Apr. 2021

Quantitative Research Internship (Remote)

- ◆ Invited to the Discover Citadel & Citadel Securities internship, a virtual event to learn more about Citadel for exceptional undergraduates. Participated in team building, intellectual competitions, and problem solving. Heard from and networked with leaders, team members, campus recruiters, and fellow participating students.
- ◆ Received Quantitative Researcher Intern Interview offers from Two Sigma, Jane Street, Bridgewater, Millennium Management LLC., and Software Engineer Intern Interview offers from Google, Meta (Facebook), etc.
- ◆ 40 hours per week; 1 week per year.

Deutsche Bank, China

Jun. 2021 -Aug. 2021

Quantitative Researcher Internship (Remote)

- ◆ Used Python to calculate the weight of different categories of assets in various strategies of asset allocation.
- ◆ Evaluated the profit and risk of various investment strategies through rate of return, Sharpe ratio, and maximum drawdown rate.
- ◆ Worked knowledge of Statistical Modeling: Linear and non-linear regression analysis. Contributed to the production of statistical reports using data.
- ◆ Collaborated closely with quantitative researchers, etc.
- ◆ 15 hours per week; 8 weeks per year.

Tencent, China

Mar. 2021 – May 2021

Intern AI Algorithm Designer/Data Analyst (Remote)

- ◆ Developed machine learning models using word2vec and cross-validation for remedying the loss of user access data in online video apps and predicting preferences for 5 million users.
- ◆ Formulated models for optimizing advertisement strategies in the videos using the deep learning platform PyTorch, a 30% improvement over the traditional xgboost-based models.
- ◆ Implemented DeepFM, and Deep Interest Network model with PyTorch.
- ◆ 15 hours per week; 8 weeks per year.

VOLUNTEER AND LEADERSHIP

Paper Reading Tutor at CEE Research Science Institute (RSI)-MIT

Summer 2024, 2023, 2022, 2021

- ◆ Helped to read and revise penultimate drafts and final papers in Number Theory, Quantum Computing, Algebra Geometry, Geometry and Graph Theory for 8 students from RSI at MIT in the summer of 2021, 2022, 2023,2024, gave them feedback and suggested revisions. Helped students prepare for the final presentation.

Urgent Aid Volunteer online

2020-Present

- ◆ Participate in flood rescue volunteer team and release disaster information through social network websites, like WeChat, TikTok; Make phone calls and message to rescue team.
- ◆ At the beginning of Covid-19 outbreak, connected with medical agency and friends in China to donate 1000 protection masks to my college.

Head and Founder of Running Math Boys Online

Jun. 2017-Present

- ◆ Guide and mentor 100+ students residing in China to solve AMC problems, which over 30 students entered AIME.
- ◆ Provide free, virtual tutoring services to over 50+ students K-12 across all levels in the south rural areas of China.

Founder and President of the Smile-Sky Club

Sep. 2015-Present

- ◆ Host students in Poor Gifted Person Plan from the southwest areas in China.
- ◆ Outreach the headmaster and director from Chenxi Special Education School to organize donation for disabled children.
- ◆ Initiated crowdfunding 50000 RMB to buy hearing aids and necessities for disabled children. Going on furthe