

Success Stems from Chance, Patience and Collaboration

Dialogue

By LONG Yun & CHEN Xi

For Professor Pierre Agostini, science first appeared as a man running back and forth across a classroom. It was during high school when his chemistry teacher, demonstrating how atoms bond, dashed from the blackboard to the wall and back again, shouting out element symbols and mimicking reaction pathways.

The other person responsible for his taste for science was his professor of electronics at the university, who showed him his first laser, a modest He-Ne.

"I'm very grateful to both of them," he said.

Agostini received the 2023 Nobel Prize in physics for "experimental methods that generate attosecond pulses of light for the study of electron dynamics in matter." In 2025, he was elected a foreign member of the Chinese Academy of Sciences (CAS).

In a recent interview with *Science and Technology Daily*, Agostini spoke about his scientific journey with humility, acknowledging the roles of chance, patience and collaboration.

A 'little peak' appears!

In 1979, working under Gérard Mainfray at CEA Paris-Saclay, a national research center of the French Alternative Energies and Atomic Energy Commission, Agostini and his colleague Guillaume Petite built a basic retarding voltage electron spectrometer and did their first experiment with their "one-shot-per-minute" laser.

Their laser fired only once per minute, making the experiment painstakingly slow. But one day, "a small, unexpected peak" appeared on screen.



Professor Pierre Agostini. (COURTESY PHOTO)

"We thought it was interesting, so we quickly wrote a paper," Agostini recalled. "But honestly, none of us realized this would become the starting point of Above-Threshold Ionization, or ATI. At the time, we still interpreted it as a higher-order perturbative effect. And we didn't yet grasp that electrons were absorbing many more photons than needed for ionization."

Ironically, after upgrading their equipment, they spent months failing to reproduce their own result. "I couldn't sleep well for weeks," he said.

In 2001, Agostini succeeded in producing and investigating a series of consecutive light pulses, in which each pulse lasted just 250 attoseconds. Potential applications of attosecond pulses include ultrafast electronics and medical diagnostics.

Discussing his Nobel Prize, he remained humble. "It did not change the trajectory of my research. With my colleague Louis DiMauro at the Ohio State University, we had been working on atto-

second physics since 2005. The prize in 2023 was surely an encouragement to continue."

Science across borders

Over decades, he has collaborated across Italy, Canada, the Netherlands, Germany, the United States, and now China. What makes international collaboration work? "I believe the human factor is key, nationally or internationally. Science is by nature international, but a successful collaboration begins with a good personal connection. That's my experience."

He first visited China around 40 years ago at the invitation of CAS. Today, touring advanced labs at Nankai University, Peking University and ShanghaiTech, he sees dramatic progress.

"My recent visits have shown me the incredible advancement of Chinese research compared to my first visit to the Institutes of Optics in Xi'an and Shanghai as a guest of CAS decades ago. It makes me regret not having been more involved with the Chinese

scientific community over those years."

In 2024, he was appointed honorary professor at Nankai University, where he established the International Joint Research Center for Ultrafast Optics and Applications to foster global cooperation in attosecond science.

'Don't fear the unexpected'

Young researchers often ask him for career advice. His response reflects his own winding path. "It is hard to guess where science will go, and there is certainly a part of chance in making a good career choice. Astronomy is a good candidate with the huge amount of new data now available. Applications of atomic physics, from atomic clocks and frequency combs to attophysics, are attracting many groups around the world. X-ray Free-Electron Lasers (XFELs) are also on the rise."

Looking ahead, attosecond science is pushing toward shorter wavelengths and higher intensities.

"One of the remaining challenges is to increase the intensity of attosecond pulses and push them deeper into the X-ray regime. The Linac Coherent Light Source, or LCLS, has already shown several orders of magnitude higher photon flux compared to high-harmonic generation, and more progress is likely at the growing number of XFEL facilities in Europe, China, Japan and (South) Korea."

And further into the future? "The light pulses on the zeptosecond timescale have yet to be demonstrated," he said. Generating a true one-attosecond pulse would require a bandwidth of hundreds of electronvolts and a carrier wavelength shorter than two nanometers, deep in the X-ray range, a regime already beyond the reach of current high-harmonic generation techniques.

Nankai University also contributed to this article.

My China Story

A Window for Mutual Understanding

By Staff Reporters

Three international students from Tianjin University (TJU) recently completed a one-week volunteer teaching program at the Nanyang middle school in Tanchang, a county in Gansu province in northwest China. Their visit was part of a broader educational support initiative designed to strengthen rural English education and promote cultural exchange.

The volunteers, Imad Alam and Ibrahim Nayab from Pakistan, and Tan Lak Hon from Malaysia, taught English to more than 200 students in the seventh to ninth grades, using storytelling, role-playing and mind mapping.

"Many students were too shy to speak," said Alam, a third-year PhD candidate in electrical engineering. "We focused on building their confidence through games, competitions and interactive activities."

At first, they had planned to have two students per class. "But almost everyone wanted to join. It was a wonderful surprise," Alam said.

A speech competition initially planned for a small group ignited widespread enthusiasm, with nearly all students eager to participate.

For Nayab, a second-year PhD student in emergency medicine previously involved in a secondary school in Pakistan, the experience was both professional and personal.

"Teaching in Tanchang allowed me to compare educational approaches and see how Chinese students are learning English," she said. "The students were curious and asked about my culture, university life, and even traditional food from my country."

Tan, who taught eighth graders, focused on helping the students express themselves in English by incorporating local elements such as food, landmarks, and traditional customs into his lessons.

"The students had a lot of enthusiasm once they felt the class was connected to their lives," he said. "They were proud to talk about their hometown in English."

Beyond the classroom, the volunteers were warmly welcomed by the local teachers and community members, who took them to scenic sites like snow-capped mountains with modern ski lifts installed. They also introduced them to regional cuisine and local customs.

"The teachers treated us like family," Alam said. "Their warmth made the experience even more unforgettable. I told the students I would always be available to guide them as a mentor and supporter."

This program is part of a long-term partnership between the School of International Education of TJU and the Nanyang middle school. The two institutions are exploring sustainable cooperation models such as hybrid teaching,



Ibrahim Nayab and Chinese students in Nanyang middle school. (COURTESY PHOTO)

teacher training and curriculum sharing. "This was not just about teaching English," Tan said. "It was about showing the students that they are part of a larger world — and that they can reach it."

The experience changed the volunteers' perspectives as well. For Tan, engaging with students in a rural setting offered insights beyond language instruction. During his second lesson, he taught the students how to use mind maps to organize their thoughts while learning about local culture.

When he played the Chinese song Rubia in class, many students were visibly moved by the line, "Life blooms like a flower."

"I thought I was going to open a window for the students," Tan said. "But in many ways, they opened one for me. I saw a different side of China, one that's hardworking, resilient, and rich in culture and warmth."

The experience also shaped Nayab's understanding of rural education in China.

"I was impressed by the discipline and structure here," she said. "Even during lunch breaks, students queued up in an orderly fashion, and their respect for teachers was evident. It gave me a deeper appreciation of how seriously China takes education, even in the most remote places."

Alam agreed, saying the students' dedication stood out. One ninth-grade student even asked to stay in touch via WeChat to practice English after school hours.

"Their motivation and curiosity reminded me why education matters," Alam said. "It's not just about books — it's about opening minds and building futures."

As China continues its efforts in rural revitalization and promoting international exchanges, such international cooperation projects are helping ensure that students can pursue opportunities and dream big regardless of location.

"These young people are the future leaders of China," Nayab added. "They just need the right support."

Traditional Eastern Wisdom

Tian Yuan Shu: Early Symbolic Algebra

By BI Weizi

Tian yuan shu, a method of algebraic computation using counting rods to solve problems, translates as "method of the heavenly element." The "heavenly element" refers to the unknown variable, which is usually represented by the letter x in modern algebra. As a positional system it makes use of the rod numerals to express polynomial (two or more algebraic terms) equations.

For example, $2x^2 + 18x - 316 = 0$ is represented as in Figure 1, and in Arabic

	2
— III 元	1 8 元
≡ — 元	- 3 1 6
Figure 1	Figure 2

numerals in Figure 2.

The 元 (yuan) represents the variable x , meaning the numbers in that line equate to $18x$. The row underneath indicates the constant term (-316), while the row above represents the coefficient for the quadratic (x^2) term. This framework can include arbitrarily high powers of the variable by adding more lines above, and negative powers by adding more lines below the constant term. Decimal values can also be expressed.

The theoretical origins of Tian yuan shu can be traced back to the mathematical treatise *Jigu Suanjing* by the early Tang Dynasty mathematician Wang Xiaotong. This book, completed around 626 AD, is the only mathematical classic among the Ten Mathematical Classics in-

dependently written by a Tang Dynasty scholar. In one volume, it contains 20 mathematical problems, covering astronomical calculations, calculations of solid volumes in civil engineering and hydraulic projects, and methods for solving cubic equations.

The *Jigu Suanjing* was the first text to systematically propose the "method of extracting roots with auxiliary terms (a numerical method for solving cubic equations with positive coefficients)." This method was later used by Jia Xian of the Northern Song Dynasty in his *Diagram of the Origin of Root Extraction Methods* for solving higher-order equations.

In modern times, Tian yuan shu's historical and cultural significance has

become more evident. Academically, it is one of the world's earliest examples of symbolic algebra, predating the work of European mathematicians, such as Francois Viete, by more than 300 years.

Furthermore, its algorithmic thinking exemplifies the highly procedural and mechanized nature of ancient Chinese mathematics. Its attempts at symbolization demonstrate that across different civilizations, humanity has been exploring the use of abstract algebraic methods involving the replacement of specific numbers with symbols. In mathematics education, Tian yuan shu is often used to demonstrate the various ways in which equations can be developed, and to help students understand symbolic language.

Hi-tech Revitalizes Hezhen People's Yimakan Storytelling

Tech+Culture

By ZHU Hong & BI Weizi

"There is a great river flowing eastward towards the sun, all the way to the sea. This dark river is called the Heilongjiang..."

On a freezing day in late December 2025, the intangible cultural heritage digital experience hall in Tongjiang city in Heilongjiang province resounded with this profound song, *The Tribe of the Rising Sun*.

The singer was no mortal but the digital avatar of Wu Baochen, a renowned artist recognized as a national-

level inheritor of Yimakan, a time-honored oral art of storytelling in the form of singing and speaking.

Yimakan has been described as the "soul" of the Hezhen people, the smallest ethnic group in China living primarily in Heilongjiang in northeast China.

Using digital facial reconstruction, 3D scanning and a digital human driving system, the veteran artist's facial features and skin texture were reproduced in such detail that it seemed the man himself was performing face-to-face.

On that day, the "Hezhen Ethnic Style Yimakan Appreciation" exchange and exhibition event opened in the hall, celebrating the ascent of Yimakan to the UNESCO Representative List of the Intangible Cultural Heritage of Humanity

from the List of Intangible Cultural Heritage in Need of Urgent Safeguarding.

As the Hezhen group has no written language, their historical memory is passed down entirely orally. In the exhibition hall, the digital Wu told the audience: "I learned to sing from my ancestors when I was young. Back then, on fishing boats and by the riverbanks, the elders would sing a section during a break from their work. These songs were about heroic feats, fishing and hunting, and the ethics of the Hezhen people."

Since its opening in August 2025, the sprawling digital experience hall has become a base for keeping Yimakan alive. Its comprehensive Yimakan database collects classic songs from numerous inheritors and uses holographic

projection to recreate the performances of veteran artists.

Virtual reality (VR) / augmented reality technology is used to create an immersive experience area showcasing the wisdom and artistry of the Hezhen.

"With VR glasses, you feel you are standing on a snow-covered plain from a hundred years ago, watching the hero Morrigan conquer all directions," a visitor to the exhibition told *Science and Technology Daily*.

In the virtual scene, snowflakes fell in a soft patter and horse hooves left tracks in the snow. Holographic images of Wu and other ancient storytellers blended into the scene, creating a wonderful fusion of ancient storytelling and modern technology.

Photo News



A contestant works on a snow sculpture at the compound for the Sun Island International Snow Sculpture Art Expo in Harbin, northeast China's Heilongjiang province, January 7, 2026. (PHOTO: XINHUA)