The topic of my digital story is The Better Butterfly Theorems, which describes how my students and I started the research and exploration of Butterfly Theorem with the aid of computer technology. The intended audience are teachers and students who have interest in mathematics and the desire to explore new things. The purpose is to encourage students and teachers to try new things with computer technology and cultivate the spirit of innovation.

#0

The Better Butterfly Theorems

Curious about this logo? Here's the story about
how my students and I research and explore the Butterfly Theorems…

#1

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The discovery of mathematics theorems are often associated with super genius (great people) like Gauss, Euler and the Bernoullis. But in 1995 two American students Dan Litchfield and Dave Goldenheim with support from Charles H. Dietri managed to discover GLaD construction with the aid of computer softwares.
The news gives me more excitement than surprise.
And in the following years, we dived into research in this way.

The Discovery Of Teenagers

“Let M be the midpoint of a chord PQ of a circle, through which two other chords AB and CD are drawn; AD cuts PQ at X and BC cuts PQ at Y. Prove that M is also the midpoint of XY.”Most recently a 1805 proof by William Wallace has been discovered in Wallace's family archives.

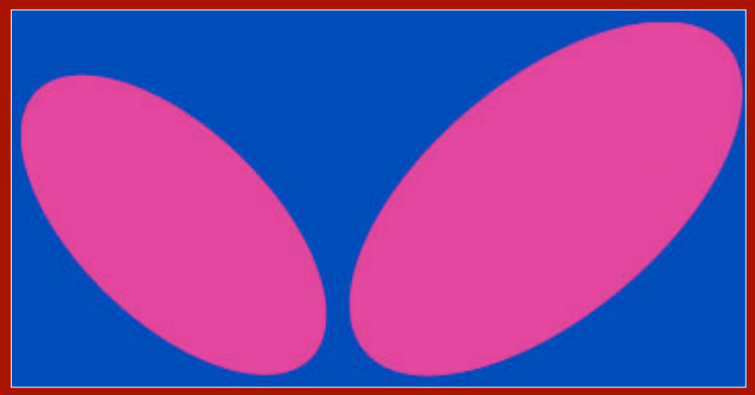
The so called butterfly problem has a long story which dates back to an 1815 issue of the Gentleman’s Diary. Usually, more interest is focused on how many ways to prove it.

Butterfly Theorem

#3

My first access to the Geometer's Sketchpad started in 1996, when I opened a selective course to explore the further function. One of my students Fengwei thought Butterfly Theorem should be researched and promoted because a real butterfly should have 4 wings, which is clearly not what the theorem has shown us. By constructing two circles, Such a small question led us to explore better butterfly theorem.Thus the journey began…

Better Butterfly Theorem



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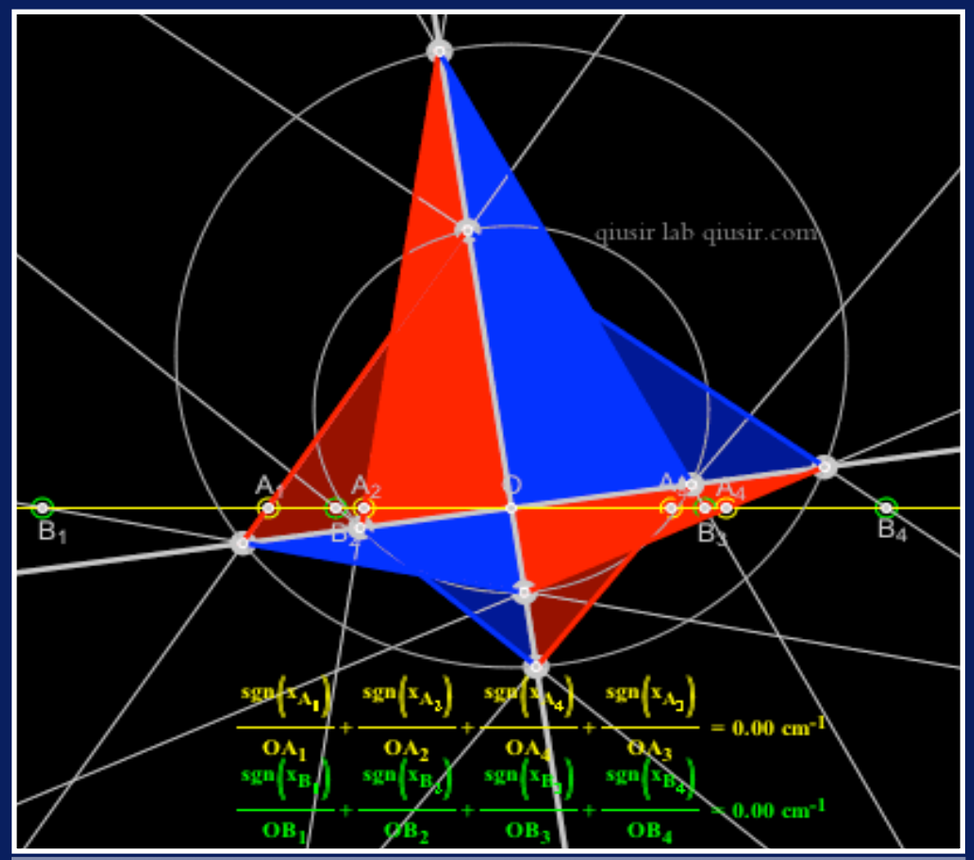
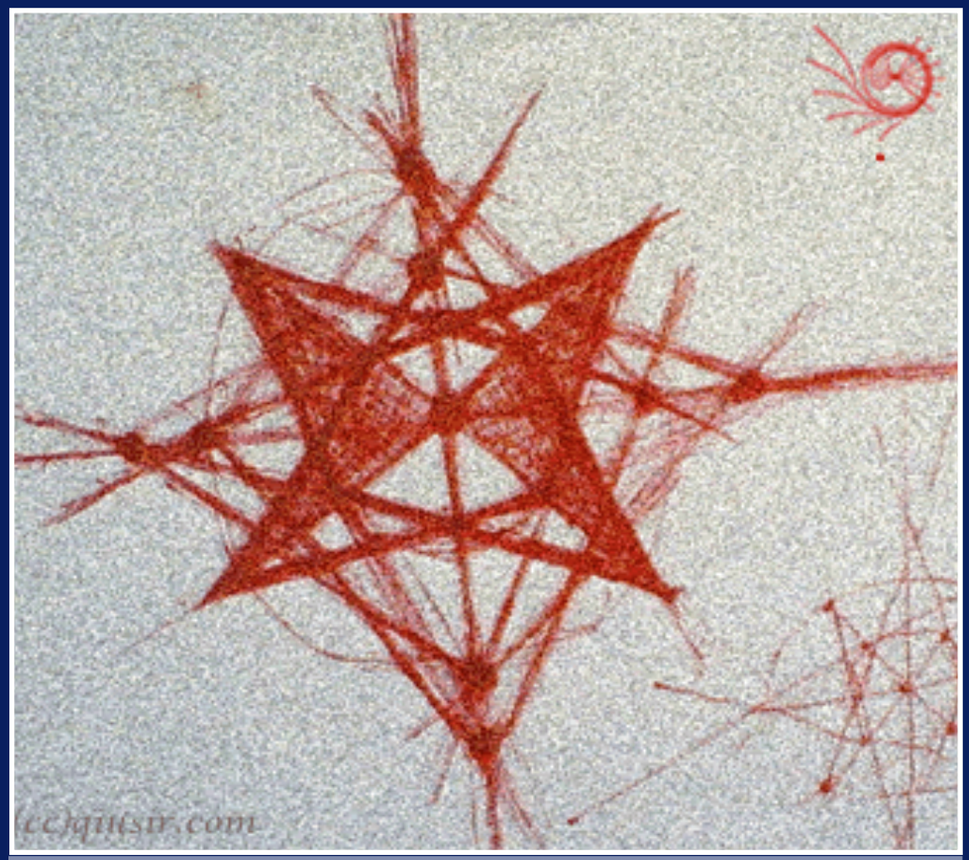
I shared our discovery with Professor Alex Bogomolny, and he published it at cut-the-knot.org, even gave us more professional development and promotion.In 1999 I construct TaiJi butterfly star, and student Xiaolong Wang, inspired by his senior who developed one circle into two, changed circle to ellipse, then to conic and special patterns etc. The whole process is a teacher-student interaction as well as a mutual motivation.



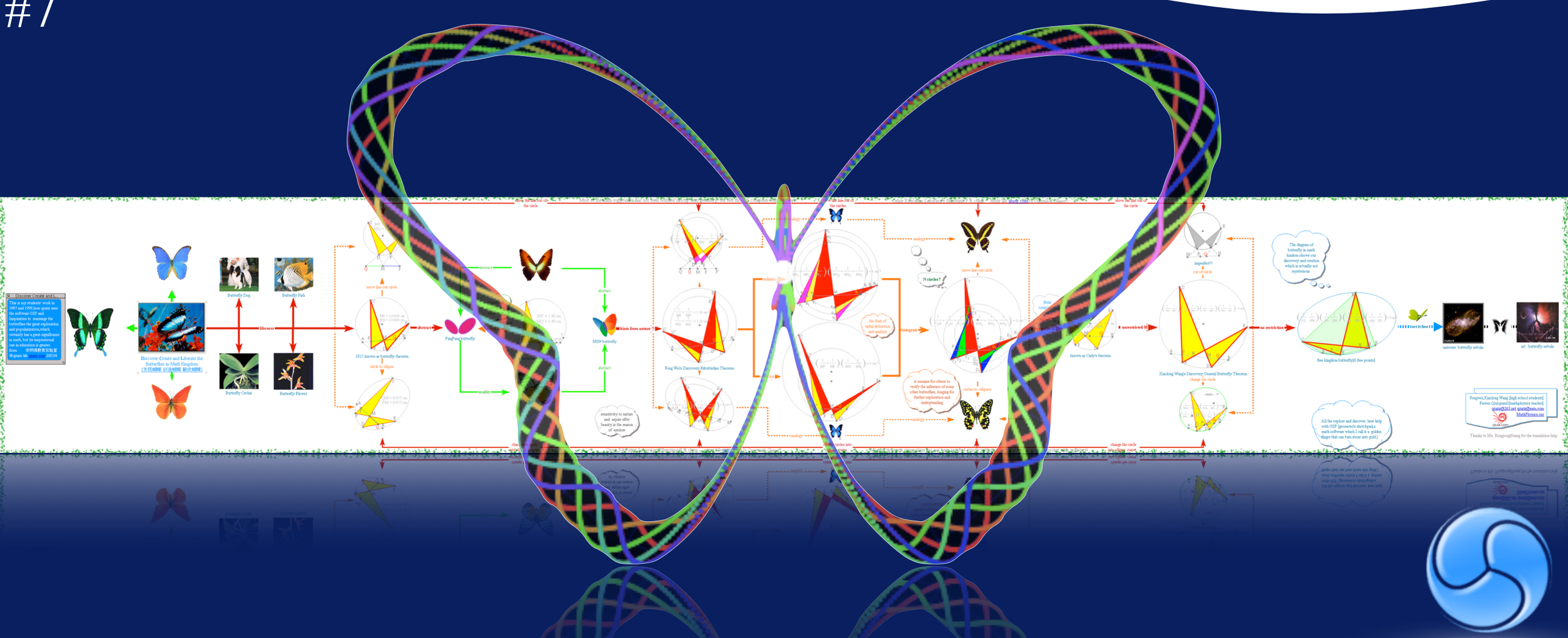


The original Theorem has given rise to a series of conclusions, which form quite a big butterfly family. The theorem gave us a new way to see butterfly and everything related: butterfly dog, butterfly fish and butterfly nebula.

Thus a butterfly family tree was born.

Butterfly Atlas

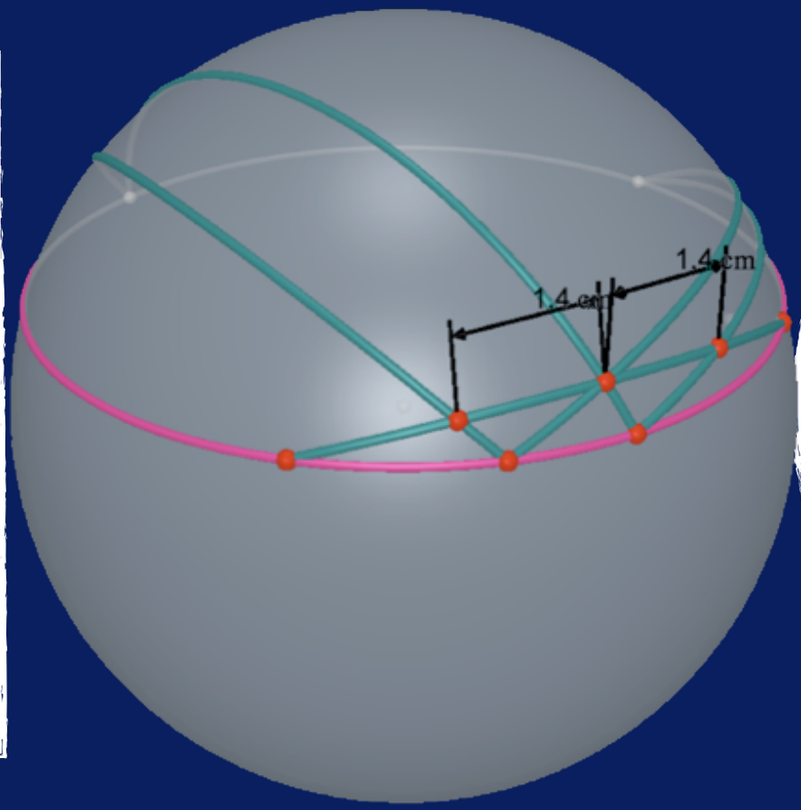
#7

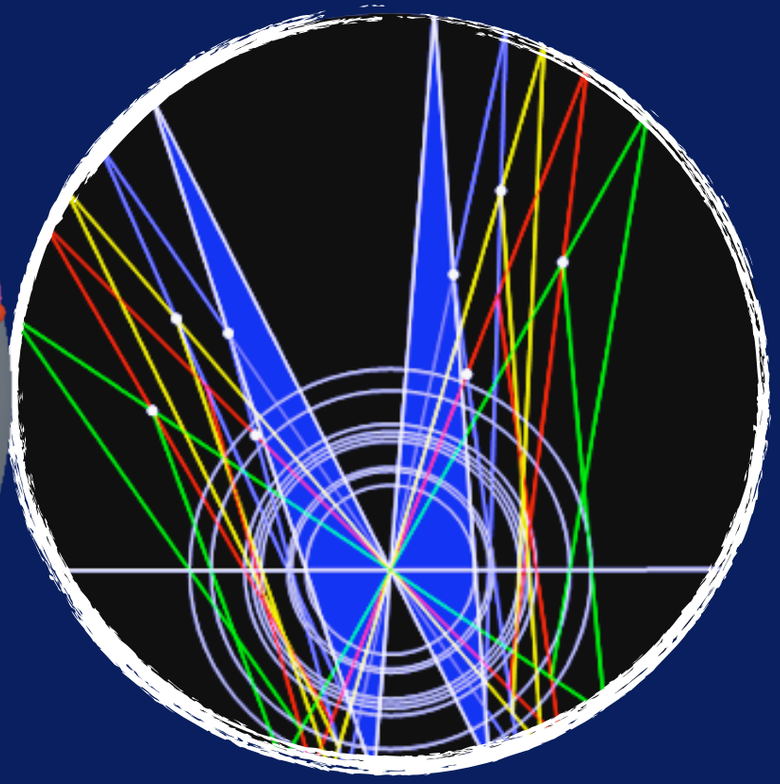


In 2004, 11-year-old Tianguang Zhang started to pursue the new structure of butterfly. Both his discovery and my Taichi butterfly star remind us of an old Chinese saying, Tao engenders one, one engenders two, two engenders three and three engenders everything.

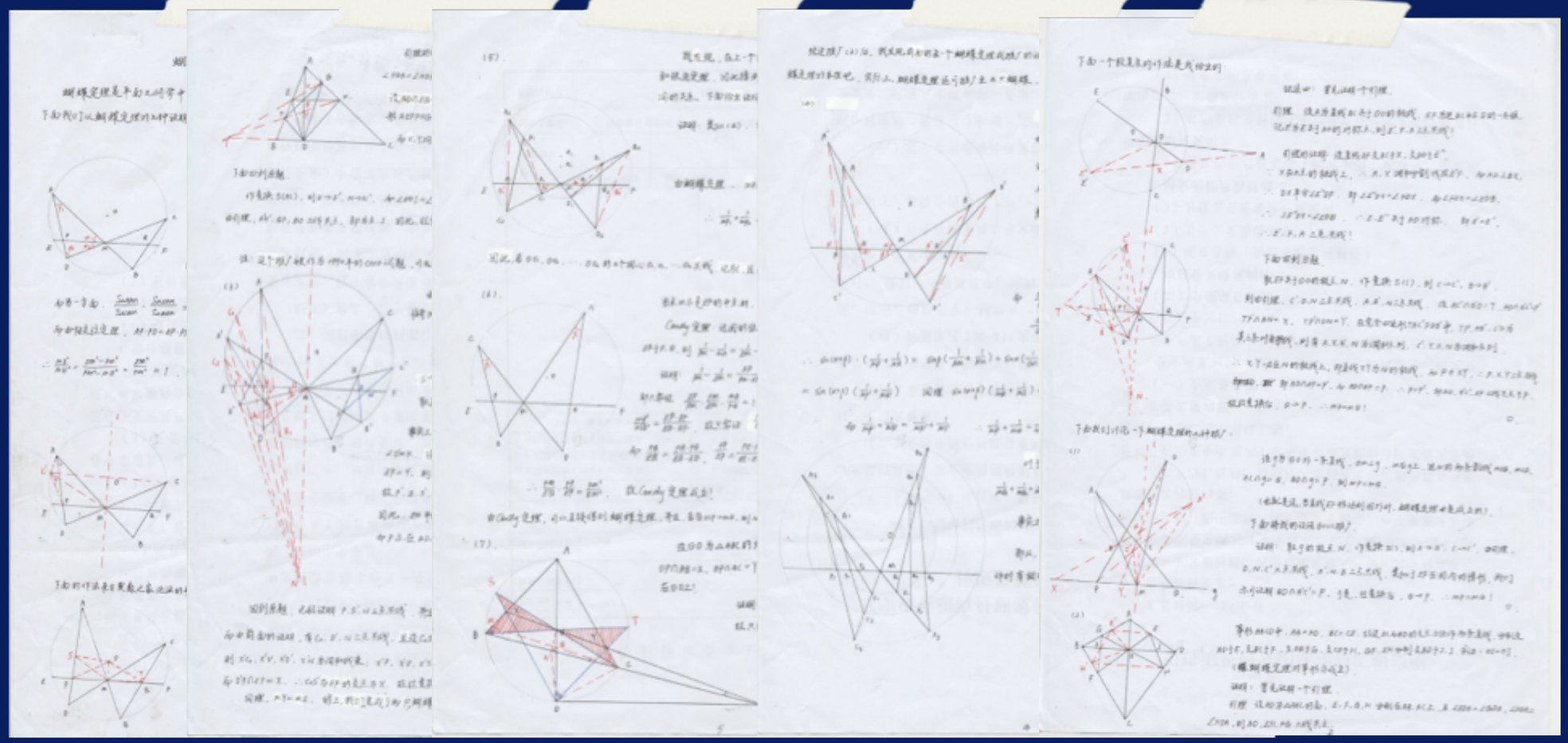
Later, Zhang reinvented the theory to 3D…

Tao engenders one…





In 2012, my student Xinyao Zhang reproved most of the theorems, but this is not the end of our exploration. We started from the old theorem, and we apply new technology, then further to generalization of the pattern, and even the golden ratio of the butterfly.All these lead to the birth of our logo.
We proved it, we discovered it, we liberated it, and we created it. All arise from a simple question: the butterfly should have 4 wings!



thanks to Lauralee

Professor Alex Bogomolny, Professor Sang Xinmin.
Feng Wei, Wang Xiaolong, Zhang Tianguang, Chengyu, Caodi, Liu Tianyi, Zhenglun Li, Wupei, Xinyao Zhang …
They are butterfly knights. It's my privilege to cooperate with them.

Acknowledgement