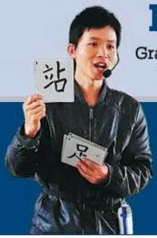

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Sea site found for neutrino observatory

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A scouting voyage in the South China Sea has succeeded in finding a suitable location for the building of a deep-sea neutrino observatory that would be China's first such facility, Shanghai Jiao Tong University announced on Friday.

Plans for Project Hai-Ling, or the Bell of the Sea, call for the observatory to be built 3,000 meters under the sea surface by around 2030 to detect astrophysical neutrinos, elementary particles that are electrically neutral and have a much smaller mass than other known elementary particles.

As high-energy astronomical messengers, neutrinos provide information to probe the most violent astrophysical sources, such as exploding stars, gamma-ray bursts, and cataclysmic phenomena involving black holes and neutron stars.

Earlier this month, a team of Chinese scientists and engineers went to the South China Sea to evaluate the feasibility of building a next generation neutrino telescope array, and the project scientists said preliminary data brought back from the voyage showed positive results.

"The water there is super clear and the current is mild. It's an ideal candidate site," said the chief scientist of the project, Xu Donglian, a research fellow at the university's Tsung-Dao Lee Institute.

"The construction of a deep-sea neutrino observatory closer to the Earth's equator will complement the global multi-messenger observatory networks."

Because neutrinos interact weakly, they are hard to observe. The existence of neutrinos was first postulated in 1930 but they were only detected in 1956.

> "The neutrino telescope has the potential to enable breakthrough scientific discoveries, such as identifying the origins of cosmic rays."
>
> **Xu Donglian,** research fellow at Shanghai Jiao Tong University's Tsung-Dao Lee Institute

Since then, several neutrino observatories have been built to capture the elusive particle as a way to study astronomical objects, such as the Sun's core and supernovas that are inaccessible to optical telescopes.

Hai-Ling's deep-sea telescope will be made of hundreds of cables draped down to the seabed, and around 20 to 30 optical sensor modules will be attached to each cable to detect the faint light in the deep sea from charged particles originating from collisions of the neutrinos and the water in the vicinity of the detector.

The idea of detecting neutrinos through the help of a large volume of transparent water was proposed by Soviet physicist Moisey Markov in 1960, but the first generation of such neutrino observatories were not big enough to have sufficient sensitivity to capture neutrinos efficiently.

The Hai-Ling project aims to build a telescope array that is several kilometers in length and width while stretching around 1 km in depth from 2,500 to 3,500 meters below sea level — like a paddy of seaweed planted on the seabed.

The world's largest current neutrino telescope, IceCube, is a cubic kilometer in size and was built more than 1,500 meters deep in South Pole ice in 2010. It made the world's first observation of cosmic neutrinos in 2013.

"The Hai-Ling will be a much larger 'net' for scientists to capture neutrino particles," Xu said, adding that the building of next-generation water-based neutrino observatories, including the Cubic Kilometre Neutrino Telescope, or KM3NeT, at the bottom of the Mediterranean Sea, and the Baikal Gigaton Volume Detector in Russia's Lake Baikal, the world's largest freshwater lake, are also expected to be completed within the decade.

"The neutrino telescope has the potential to enable breakthrough scientific discoveries, such as identifying the origins of cosmic rays," she said. "The project can also push forward interdisciplinary studies among particle physics, astrophysics and marine geology."

Tian Xinliang, associate professor at the State Key Laboratory of Ocean Engineering at the university, said the project posed great challenges for engineering as the telescope will occupy more than 10 cubic kilometers of water and is expected to operate stably for 20 to 30 years.

"How to design, install and maintain this largest deep-sea scientific infrastructure in human history requires a lot of innovation and cooperation across different expertise," he said. "Thankfully our university has unique strengths in shipbuilding, ocean engineering, materials and electronics, and we are positive that we will overcome those difficulties."