The Fundamentalist

Professor Oh Choo Hiap  
A*STAR, National Science Award 2006 team: Oh Choo Hiap, Berthold-Georg Englert, Dagomir Kaszlikowski (NUS) and Kwek Leong Chuan (NTU)

What does a quantum physicist have in common with a child? They both ask very fundamental questions.

Choo Hiap confesses that as a child he was always asking questions. He wanted to know how things work. He had the tendency to try and understand things at the fundamental level and reduce it to first principles.

“I remember that time I wanted to know how the clock works. In those days, it was the bulky mechanical clock. I opened it up to see the inside. But I didn’t know how to put it back. Of course my parents were not pleased.”

Although that was the end of the clock, his passion for fundamental enquiries has never waned. It led him to study physics at Otago University, the oldest university in New Zealand under a Colombo Plan Scholarship. He stayed on to do his PhD in high energy physics, which relates to the study of the smallest particles, quarks. Today he is still asking fundamental questions of physics.

“By nature, physics tries to probe the fundamentals. In the past centuries people have a good understanding of fundamental entities such as space, time, force and energy.

Now the big question is ‘what is information?’ People don’t understand ‘information’ from physics’ point of view, its fundamentals. How do you process it? How do you manipulate it? For the last 15 years or so, we’ve been trying to understand quantum information. It has turned out to be at the centre stage of physics.

In 1997 we started a group in the NUS to look into this new area, quantum information. This area not only covers the deep fundamental issues in physics; it has also many practical implications, particularly on computers which process information and may become the basis of future technology. The quantum computer, if realizable at all, is based on the laws of quantum physics, unlike the present computer which is essentially based on laws in classical physics.”

One of the necessary requirements in setting up a study on a new area is funding. Fortunately, the Quantum Information group had the support from A*STAR right from the beginning; an initial grant was provided under the Temasek Professorship Project in 2002. With Professor Artur Ekert from Oxford University as the Temasek Professor, the Quantum Information group has borne much fruit, judging by the reputation it has won for itself as one of the strongest in the field. Very recently, the Research Centre of Excellence on Quantum Information Science and Technology (QIST) has been set up. The Quantum Information Initiative led by the team of Oh Choo Hiap, Berthold-Georg Englert, Dagomir Kaszlikowski (NUS) and Kwek Leong Chuan (NTU) has advanced the understanding of coherent quantum phenomena and how the governing fundamental laws of physics can be harnessed to dramatically improve the acquisition, transmission and processing of information. They received the A*STAR, National Science Award 2006, for their work. So where is quantum information technology heading?

“Today quantum cryptography is already here in the laboratory, not quite commercially ready yet. Quantum communication and quantum teleportation is another reality. Another project is quantum memory. We want to understand how memory can be stored and retrieved at the quantum level. It will be useful for the quantum computer which handles quantum memory storage and retrieval.”

This modest man, who also has great interest in world culture, history and philosophy, gets very frustrated sometimes when the results he had worked on turned out to be wrong. That is the nature of research work - learning from the mistakes and moving on to break new grounds, hopefully.

“It is very exciting when you find something new. You know it is new knowledge. This is like having a new born baby. There’s no word to describe the feeling”