

### High Precision Measurement of Neutrino Oscillation at Daya Bay

The recent discovery of neutrino oscillation – a neutrino travelling in space transforms from one type to another – has profound impacts on particle physics, astrophysics and cosmology. The Daya Bay Reactor Neutrino Oscillation Experiment aims to measure a key but yet unknown neutrino oscillation parameter,  $\theta_{13}$ , to an unprecedented precision of better than 3 degrees, which is critical to the design of future experimental tests of a possible explanation of why matter dominates anti-matter in the universe, a key condition for our existence.

The Hong Kong team has been an active member of the Daya Bay Collaboration, an international team with 38 institutions. We will contribute to the commissioning and monitoring of the experiment and analysis of data, with the help of a subsystem of the antineutrino detector built by our team. We will also design and construct a continuous radon monitoring system as well as a cover gas system to minimize radon contamination of the detectors.

### 大亞灣實驗：中微子振蕩的高精密測量

中微子振蕩是近年發現的一個重要物理現象。自然界有三類中微子 ( $\nu_e, \nu_\mu, \nu_\tau$ )，當一粒中微子在空間傳播時，它會不斷由一類轉化成另外兩類。這個發現，不但開啓了超越粒子物理標準模型的窗口，亦對宇宙學及天體物理學中眾多領域有舉足輕重的影響。大亞灣中微子實驗的目標，是以前所未有的高精密度（高於 0.01）量度中微子振蕩的一個基本卻未知的參數  $\theta_{13}$  的數值。這對於中微子物理的發展至為重要。

本港兩所大學的研究人員，自開始便積極參予這項由國際三十八所科研單位合作的重要研究工作。利用我們設計及建造的子系统，我們將參予實驗監控及數據分析。我們亦將設計及建造一個連續的氬氣監測系統，以及中微子探測器的密封氬氣系統，以確保探測器不受污染。



香港中文大學及香港大學師生在�港仔隧道實驗室建造粒子探測器，用以協助設計及優化大亞灣中微子探測器。Researchers from CUHK and HKU are building a prototype cosmic rays and neutron detector in the Aberdeen Tunnel Laboratory in Hong Kong to help design and optimize the neutrino detector in Daya Bay.



大亞灣中微子振蕩實驗 - 大亞灣近端地下實驗室（左圖）已建造完成，而首兩個反中微子探測器（右圖）亦已完成裝嵌，並通過一系列測試。The Daya Bay Neutrino Oscillation Experiment - the Daya Bay Near Site underground experimental hall (left) is ready for use, and the first pair of anti-neutrino detectors (right) have been assembled and tested.