講座大師 Douglas D. Osheroff 專題演講一

Understanding the Columbia Shuttle Accident

Abstract :

On February 1, 2003, the NASA space shuttle Columbia broke apart during re-entry over East Texas at an altitude of 200,000 feet and a velocity of approximately 12,000 mph. All aboard perished. The speaker was a member of the board that investigated the origins of this accident, both physical and organizational. In his talk he will describe how the board was able to determine with almost absolute certainty the physical cause of the accident. In addition, the speaker will discuss its organizational and cultural causes, which are rooted deep in the culture of the human spaceflight program. Why did NASA continue to fly the shuttle system despite the persistent failure of a vital sub-system that it should have known did indeed pose a safety risk on every flight? Finally, the speaker will touch on the future role humans are likely to play in the exploration of space.

講座大師 Douglas D. Osheroff 演講與對談一

氦 3 由 A 相態到 B 相態的超流體性：一度相變的模型

Superfluid 3He A to B: A Model First Order Phase Transition

綱要：
系統由一個相態連續轉化到另一個相態的二度相變，已由 Kenneth Wilson 和其同事所發展出的重整化群組理論得到解釋，並因此獲得 1982 年諾貝爾獎。我們更為熟悉如水結成冰的一度相變，其系統的性質會隨著溫度變化發生不連續轉變，在此溫度下，兩種不同的相態因介面分離而同時存在。表面能量（或稱表面張力）和介面有關，使得大部份的一度相變都不是正好在兩個相態的自由能相等時發生。通常這些相變會過度冷卻，高溫的相態變成亞穩態而在低於一度相變溫度下存在，很少會過熱。講者將以氦 3 的 A 相態到 B 相態的一度相變來討論這些想法。此相變擁有過度冷卻的世界紀錄，其原因仍然未定。

In second order phase transitions a system changes continuously from one phase to the other. Such transitions are all explained by the renormalization group theory developed by Kenneth Wilson and co-workers, for which he was awarded the Nobel Prize in 1982. We are more familiar with first order transitions, such as the freezing of water. In these, the properties of the system change discontinuously as a function of temperature at the transition, and at that temperature two very distinct phases can co-exist, separated by an interface. There is an energy associated with this interface, the surface energy, or surface tension. One consequence of this surface energy is that most first order phase transitions do not occur precisely where the free energies of the two phases cross. Frequently such transitions supercool, with the high temperature phase metastable below the first order transition temperature. Less often, such transitions can superheat. The speaker will illustrate these ideas with the rather remarkable first order phase transition between the superfluid 3He A phase to B phase. This transition holds the world record for supercooling, and the origin of the eventual transition seen is still a matter of debate.

講座大師 Douglas D. Osheroff 演講與對談二

The Nature of Discovery in Physics
在物理中發現的本質

綱要：
對瞭解自然界有極其深遠的重要發現經常是無法預期的。那麼這些發現是如何產生呢？在研究上有沒有可行的策略增加這些發現呢？在這個演講中我會討論好幾個著名的發現和用自己研究生涯中的一些發現為例提出一些看法。

By their very nature, those discoveries which most influence the way we understand nature cannot be anticipated. How then, are such discoveries made, and are there strategies in research which can increase the chance that such discoveries will be made. The speaker will discuss a number of well known discoveries, and illustrate the ideas which they seem to suggest by considering a number of discoveries he has made in his own research career, not all of which are either famous or important.