所有題目的讀者皆預設爲報紙讀者。

1. 附件一爲 2015 年諾貝爾物理學獎之新聞稿(英文)。附件二爲 2015 諾貝爾物理學獎的介紹。

   (a) 請根據這兩份資料，寫出一篇 600 字的報導（須自訂標題）。(30%)
   (b) 您的這篇新聞將被貼在 facebook 上的粉絲頁上。請爲這篇新聞撰寫一段 50 字內的文字以吸引讀者。(10%)
   (c) 2015 諾貝爾物理獎得主梶田隆章教授於 2015 年 12 月底訪問台灣。您被指派對梶田教授進行二十分鐘的一對一專訪。請問您希望提出什麼問題？請至少提出四個問題，並對每個題目寫出 50 個字以內的提問理由。並請由這些問題中選出"一個"您認爲最重要的問題。(20%)

   註：作答時，人名、地名等專有名詞得使用英文。

2. 附件三爲中研院天文所新聞稿。請改寫此新聞稿爲 300 字以內之新聞。(20%)

3. 2015 諾貝爾生醫獎的得主之一爲屠呦呦，她對青蒿素的研究開創了對抗瘧疾的新療法，因此得到今年諾貝爾獎的肯定。附件四爲中央社所發的兩篇相關報導。

   請以屠呦呦獲得諾貝爾醫學獎爲起點，設計一個專題報導，討論對中藥與西藥之間的相互關係。
   (a) 專題報導標題 (5%)
   (b) 段落結構 (15%)

見背面

附件一：

Press Release

6 October 2015

The Royal Swedish Academy of Sciences (瑞典皇家科學院) has decided to award the Nobel Prize in Physics for 2015 to

Takaaki Kajita (梶田隆章)
Super-Kamiokande Collaboration
University of Tokyo, Kashiwa, Japan

and

Arthur B. McDonald (麥當勞)
Sudbury Neutrino Observatory Collaboration
Queen's University, Kingston, Canada

"for the discovery of neutrino oscillations (微中子震盪), which shows that neutrinos (微中子) have mass"

Metamorphosis in the particle world

The Nobel Prize in Physics 2015 recognizes Takaaki Kajita in Japan and Arthur B. McDonald in Canada, for their key contributions to the experiments which demonstrated that neutrinos change identities. This metamorphosis requires that neutrinos have mass. The discovery has changed our understanding of the innermost workings of matter and can prove crucial to our view of the universe.

Around the turn of the millennium, Takaaki Kajita presented the discovery that neutrinos from the atmosphere switch between two identities on their way to the Super-Kamiokande detector (超級神岡偵測器) in Japan.

Meanwhile, the research group in Canada led by Arthur B. McDonald could demonstrate that the neutrinos from the Sun were not disappearing on their way to Earth. Instead they

接次頁

were captured with a different identity when arriving to the Sudbury Neutrino Observatory (Sudbury 微中子觀測站).

A neutrino puzzle that physicists had wrestled with for decades had been resolved. Compared to theoretical calculations of the number of neutrinos, up to two thirds of the neutrinos were missing in measurements performed on Earth. Now, the two experiments discovered that the neutrinos had changed identities.

The discovery led to the far-reaching conclusion that neutrinos, which for a long time were considered massless, must have some mass, however small.

For particle physics this was a historic discovery. Its Standard Model of the innermost workings of matter had been incredibly successful, having resisted all experimental challenges for more than twenty years. However, as it requires neutrinos to be massless, the new observations had clearly showed that the Standard Model cannot be the complete theory of the fundamental constituents of the universe.

The discovery rewarded with this year's Nobel Prize in Physics have yielded crucial insights into the all but hidden world of neutrinos. After photons, the particles of light, neutrinos are the most numerous in the entire cosmos. The Earth is constantly bombarded by them.

Many neutrinos are created in reactions between cosmic radiation and the Earth's atmosphere. Others are produced in nuclear reactions inside the Sun. Thousands of billions of neutrinos are streaming through our bodies each second. Hardly anything can stop them passing; neutrinos are nature's most elusive elementary particles.

Now the experiments continue and intense activity is underway worldwide in order to capture neutrinos and examine their properties. New discoveries about their deepest secrets are expected to change our current understanding of the history, structure and future fate of the universe.

Takaaki Kajita, Japanese citizen. Born 1959 in , Japan. Ph.D. 1986 from University of Tokyo, Japan. Director of Institute for Cosmic Ray Research and Professor at University of Tokyo, Kashiwa, Japan.

Arthur B. McDonald, Canadian citizen. Born 1943 in Sydney, Canada. Ph.D. 1969 from California Institute of Technology, Pasadena, CA, USA. Professor Emeritus at Queen's University, Kingston, Canada.

Prize amount: SEK 8 million, to be shared equally between the Laureates.

見背面

附件二

KUNGL.
VETENSKAPS-
AKADEMIEN
THE ROYAL SWEDISH ACADEMY OF SCIENCES

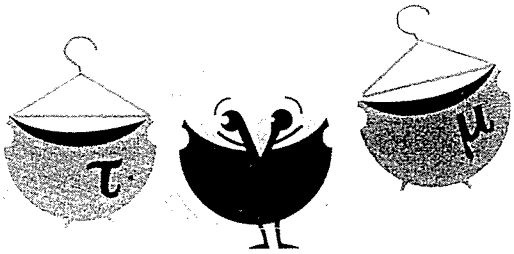
THE NOBEL PRIZE IN PHYSICS 2015

POPULAR SCIENCE BACKGROUND

The chameleons of space

They solved the neutrino puzzle and opened a new realm in particle physics. ***Takaaki Kajita*** *and* ***Arthur B. McDonald*** *were key scientists of two large research groups, Super-Kamiokande and Sudbury Neutrino Observatory, which discovered the neutrinos mid-flight metamorphosis.*

The hunt was on – deep inside the Earth in gigantic facilities where thousands of artificial eyes waited for the right moment to uncover the secrets of neutrinos. In 1998, Takaaki Kajita presented the discovery that neutrinos seem to undergo metamorphosis; they switch identities on their way to the Super-Kamiokande detector in Japan. The neutrinos captured there are created in reactions between cosmic rays and the Earth's atmosphere.



Torn between identities – tau-, electron- or muon-neutrino?

Meanwhile, on the other side of the globe, scientists at the Sudbury Neutrino Observatory in Canada, SNO, were studying neutrinos coming from the Sun. In 2001, the research group led by Arthur B. McDonald proved that these neutrinos, too, switch identities.

Together, the two experiments have discovered a new phenomenon – neutrino oscillations. A far-reaching conclusion of the experiments is that the neutrino, for a long time considered to be massless, must have a mass. This is of ground-breaking importance for particle physics and for our understanding of the universe.

Reluctant heroes

We live in a world of neutrinos. Thousands of billions of neutrinos are flowing through your body every second. You cannot see them and you do not feel them. Neutrinos rush through space almost at the speed of light and hardly ever interact with matter. Where do they come from?

Some were created already in the Big Bang, others are constantly being created in various processes in space and on Earth – from exploding supernovas, the death of massive stars, to reactions in nuclear power plants and naturally occurring radioactive decays. Even inside our bodies an average of 5,000 neutrinos per second is released when an isotope of potassium decays. The majority of those that reach the Earth originate in nuclear reactions inside the Sun. Second only to particles of light, photons, the neutrinos are the most numerous particles in the entire universe.

For a long time, however, their existence was not even certain. Quite the opposite; when the particle's existence was proposed by the Austrian Wolfgang Pauli (Nobel Prize Laureate in 1945) it was mainly in a desperate attempt to explain conservation of energy in beta decay, a type of radioactive decay in atomic nuclei. In December 1930, Pauli wrote a letter to his physicist colleagues whom he addressed as *Dear Radioactive Ladies and Gentlemen*. In this letter he suggested that some of the energy is carried away by an electrically neutral, weakly interacting and very light particle. Pauli, himself, hardly believed in the existence of this particle. He supposedly stated: *"I have done a terrible thing, I have postulated a particle that cannot be detected"*.

接次頁

Soon the Italian Enrico Fermi (Nobel Prize Laureate in 1938) was able to demonstrate an elegant theory that included Pauli's lightweight, neutral particle. It was called the neutrino. No one could predict that this tiny particle would revolutionise both particle physics and cosmology.

It would take a quarter of a century before the neutrino was actually discovered. The opportunity came about in the 1950s, when neutrinos began to stream in great numbers from nuclear power plants then being built. In June 1956, two American physicists, Frederick Reines (Nobel Prize Laureate in 1995) and Clyde Cowan sent a telegram to Wolfgang Pauli – the neutrinos had left traces in their detector. The discovery showed that the ghostly neutrino, or *Poltergeist* as it had been called, was a real particle.

A peculiar trio

This year's Nobel Prize in Physics awards a discovery that solved a long-standing neutrino puzzle. Since the 1960s, scientists had theoretically calculated the number of neutrinos that were created in the nuclear reactions that make the Sun shine, but when carrying out measurements on Earth, up to two thirds of the calculated amount was missing. Where did the neutrinos go?

There was no lack of suggestions. Maybe there was something wrong with the theoretical calculations of how the neutrinos are produced in the Sun? One of the other suggestions to solve the solar neutrino puzzle was that the neutrinos change identities. According to the Standard Model of particle physics there are three types of neutrinos – electron-neutrinos, muon-neutrinos and tau-neutrinos. Each has its respective charged partner, the electron, and its two much heavier and short-lived relatives, the muon and the tau. The Sun only produces electron-neutrinos. But if they would be transformed to muon-neutrinos or tau-neutrinos on their way to Earth, that would make the deficit of the captured electron-neutrinos understandable.

Hunting for neutrinos underground

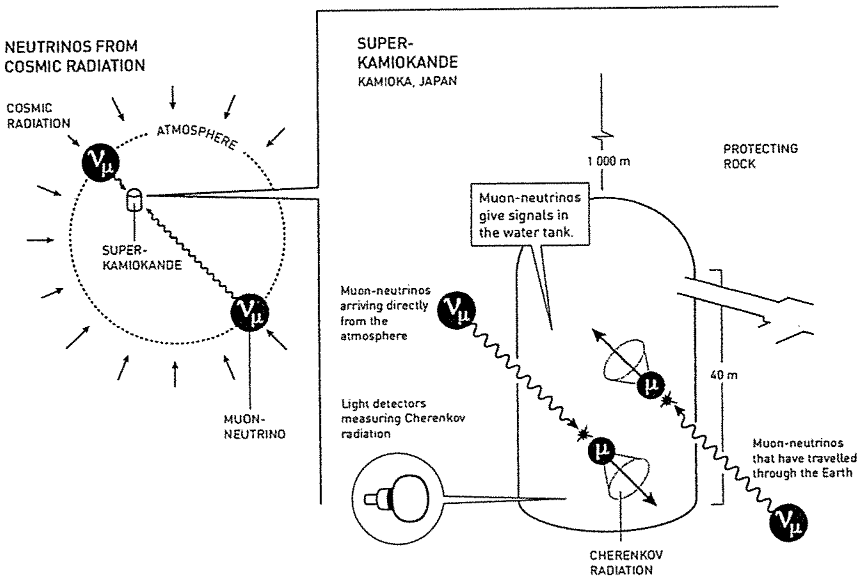
Speculations about the neutrino's identity change remained just speculations until larger and more sophisticated facilities were taken into operation. Day and night, neutrinos were hunted in colossal detectors built deep underground, in order to shield out noise from cosmic radiation from space and from spontaneous radioactive decays in the surroundings. Yet, it is a difficult art to separate a few true neutrino signals from billions of false ones. Even the air in the mines and the detector material contain naturally occurring trace elements that decay and interfere with the measurements.

Super-Kamiokande became operational in 1996 in a zinc mine 250 kilometres North-West of Tokyo, while Sudbury Neutrino Observatory, built in a nickel mine in Ontario, began the observations in 1999. Together they would unveil the chameleon-like nature of the neutrino, the discovery that is rewarded with this year's Nobel Prize in Physics.

Super-Kamiokande is a gigantic detector built 1,000 metres below the Earth's surface. It consists of a tank, 40 metres high and as wide, filled with 50,000 tonnes of water. The water is so pure that light beams can travel 70 metres before their intensity is halved, compared to just a few metres in an ordinary swimming pool. More than 11,000 light detectors are located in the tank's top, sides and bottom, with the task to discover, amplify and measure very weak light flashes in the ultra-pure water.

The vast majority of neutrinos pass right through the tank, but every now and then, a neutrino collides with an atomic nucleus or an electron in the water. In these collisions charged particles are created – muons from muon-neutrinos and electrons from electron-neutrinos. Around the charged particles, faint flashes of blue light are generated. This is Cherenkov light, which arises when a particle travels faster than the speed of light. This is not in contradiction to Einstein's theory of relativity, which states that nothing can move

見背面



Super-Kamiokande detects atmospheric neutrinos. When a neutrino collides with a water molecule in the tank, a rapid, electrically charged particle is created. This generates Cherenkov radiation that is measured by the light sensors. The shape and intensity of the Cherenkov radiation reveals the type of neutrino that caused it and from where it came. The muon-neutrinos that arrived at Super-Kamiokande from above were more numerous than those that travelled through the entire globe. This indicated that the muon-neutrinos that travelled longer had time to change into another identity on their way.

faster than light in vacuum. In the water, the light is slowed down to 75 per cent of its maximum speed, and can be "overtaken" by the charged particles. The shape and intensity of the Cherenkov light reveals what type of neutrino it is caused by, and from where it comes.

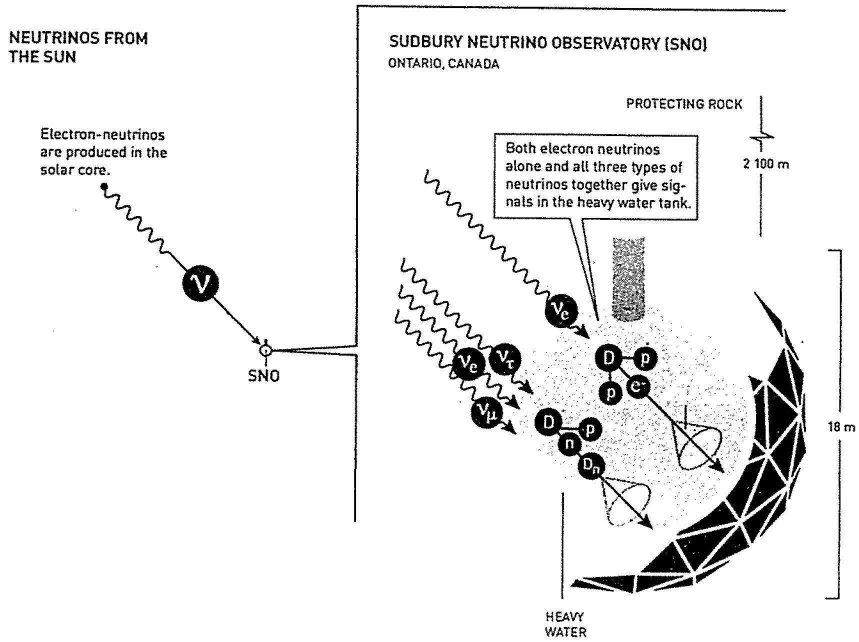
A solution to the enigma

During its first two years of operation, Super-Kamiokande sifted out about 5,000 neutrino signals. This was a lot more than in previous experiments, but still fewer than what was expected when scientists estimated the amount of neutrinos created by the cosmic radiation. Cosmic radiation particles come from all directions in space and when they collide at full speed with molecules in the Earth's atmosphere, neutrino showers are produced.

Super-Kamiokande caught muon-neutrinos coming straight from the atmosphere above, as well as those hitting the detector from below after having traversed the entire globe. There ought to be equal numbers of neutrinos coming from the two directions; the Earth does not constitute any considerable obstacle to them. But the muon-neutrinos that came straight down to Super-Kamiokande were more numerous than those first passing through the globe.

This indicated that muon-neutrinos that travelled longer had time to undergo an identity change, which was not the case for the muon-neutrinos that came straight from above and only had travelled a few dozen kilometres. As the number of electron-neutrinos arriving from different directions were in agreement with expectations, the muon-neutrinos must have switched into the third type – tau-neutrinos. However, their passage could not be observed in the detector.

接次頁



Sudbury Neutrino Observatory detects neutrinos from the Sun, where only electron-neutrinos are produced. The reactions between neutrinos and the heavy water in the tank yielded the possibility to measure both electron-neutrinos and all three types of neutrinos combined. It was discovered that the electron-neutrinos were fewer than expected, while the total number of all three types of neutrinos combined still corresponded to expectations. The conclusion was that some of the electron-neutrinos had changed into another identity.

A decisive piece of the puzzle fell in place when Sudbury Neutrino Observatory, SNO, performed their measurements of neutrinos arriving from the Sun, where the nuclear processes only give rise to electron-neutrinos. Two kilometres below the Earth's surface the rushing electron-neutrinos were monitored by 9,500 light detectors in a tank filled with 1,000 tonnes of heavy water. It is different from ordinary water in that each hydrogen atom in the water molecules has an extra neutron in its nucleus, creating the hydrogen isotope deuterium.

The deuterium nucleus offers additional possibilities for the neutrinos to collide in the detector. For some reactions only the amount of electron-neutrinos could be determined, while others allowed scientists to measure the amount of all three types of neutrinos together, without distinguishing them from each other.

Since only electron-neutrinos were supposed to arrive from the Sun, both ways of measuring the number of neutrinos should yield the same result. Hence, if the detected electron-neutrinos were fewer in number than all three neutrino types together, this would indicate that something had happened to the electron-neutrinos during their 150 million kilometre long journey from the Sun.

Out of the over 60 billion neutrinos per square centimetre that every second reach the Earth on their way from the Sun, the Sudbury Neutrino Observatory captured only three per day during its first two years of operation. This corresponded to a third of the expected number of electron-neutrinos that should have been caught in the detector. Two thirds had disappeared. The sum however, if counting all three types together, corresponded to the expected number of neutrinos. The conclusion was that the electron-neutrinos must have changed identities on the way.

Metamorphosis in the quantum world

The two experiments confirmed the suspicion that neutrinos can change from one identity to another. The discovery have spurred many new experiments and have forced particle physicists to think in new ways.

Together these two experiments have given rise to a ground-breaking conclusion: the neutrino's metamorphosis requires that the neutrinos have mass. Otherwise they cannot change. How, then, does this metamorphosis come about?

Quantum physics is required to explain this magic. In the quantum world, particle and wave are different aspects of the same physical state. A particle with a certain energy is described by a corresponding wave of a certain frequency. In quantum physics the electron-, muon- and tau-neutrinos are represented by superposed waves that correspond to neutrino states with different masses.

When the waves are in phase it is not possible to distinguish the different neutrino states from each other. But when neutrinos travel through space the waves go out of phase. Along the way the waves are superposed in varying ways. The superposition in any given location yields the probability for what type of neutrino is most likely to be found there. The probabilities vary from one location to another, they oscillate, and the neutrinos appear in their various identities.

This peculiar behaviour is thus due to the differences in neutrino masses. Experiments indicate that these differences are extremely small. The mass of the neutrino is also estimated to be very small, although it has never been measured directly. Nevertheless, since neutrinos exist in enormously large quantities in the universe, the sum of their very tiny masses becomes significant. The combined weight of the neutrinos is estimated to be roughly equal to the weight of all visible stars in the universe taken together.

Gate to new physics

The discovery of the neutrino's mass has been ground-breaking for particle physics. Its Standard Model of the innermost parts of matter had been immensely successful and for over twenty years it had resisted all experimental challenges. But the model requires that neutrinos are massless. The experiments have thus revealed the first apparent crack in the Standard Model. It has become obvious that the Standard Model cannot be the complete theory of how the fundamental constituents of the universe function.

Several key questions about the nature of the neutrino need to be answered before new theories beyond the Standard Model can be fully developed. What are the neutrinos' masses? Why are they so lightweight? Are there more types than the three currently known? Are neutrinos their own antiparticles? Why are they so different from other elementary particles?

The discovery that is awarded with this year's Nobel Prize in Physics have yielded crucial insights into the almost entirely hidden world of the neutrino. The experiments are continuing and intense activity is under way around the world to capture the neutrinos and examine their properties. New discoveries of the neutrino's closely guarded secrets are expected to change our understanding of the history, structure and future fate of the universe.

接次頁

LINKS AND FURTHER READING

Additional information on this year's prizes, including a scientific background in English, is available on the website of the Royal Swedish Academy of Sciences, *http://kva.se*, and at *http://nobelprize.org*. There, and at *http://kvatv.se*, you can watch video footage of the press conferences, the Nobel Lectures and more. Information on exhibitions and activities related to the Nobel Prizes and the Prize in Economic Sciences is available at *www.nobelmuseum.se*.

Books

Jayawardhana, R. (2013) *Neutrino hunters: The Thrilling Chase for a Ghostly Particle to Unlock the Secrets of the Universe*, Scientific American/Farrar, Straus and Giroux

Close, F. (2010) *Neutrino*, Oxford University Press

Popular science articles

Hulth, P.O. (2005) High Energy Neutrinos from the Cosmos, *http://www.nobelprize.org/nobel_prizes/themes/physics/hulth/*

Bahcall, J.N. (2004) Solving the Mystery of the Missing Neutrinos, *http://www.nobelprize.org/nobel_prizes/themes/physics/bahcall/*

McDonald, A. B., Klein, J. R. and **Wark, D. L.** (2003) Solving the Solar Neutrino Problem, *Scientific American*, Vol. 288, Nr 4, April

Kearns, E., Kajita, T. and **Totsuka, Y.** (1999) Detecting Massive Neutrinos, *Scientific American*, Vol. 281, Nr 2, August

Links

Super-Kamiokande Official Homepage: *www-sk.icrr.u-tokyo.ac.jp/sk/index-e.html*

Sudbury Neutrino Observatory Homepage: *sno.phy.queensu.ca*

THE LAUREATES

TAKAAKI KAJITA

Japanese citizen. Born 1959 in Higashimatsuyama, Japan. Ph.D. 1986 from University of Tokyo, Japan. Director of Institute for Cosmic Ray Research and Professor at University of Tokyo, Kashiwa, Japan.

www.icrr.u-tokyo.ac.jp/about/greeting_eng.html

ARTHUR B. MCDONALD

Canadian citizen. Born 1943 in Sydney, Canada. Ph.D. 1969 from California Institute of Technology, Pasadena, CA, USA. Professor Emeritus at Queen's University, Kingston, Canada.

www.queensu.ca/physics/arthur-mcdonald

Science Editors: Lars Bergström, Olga Botner, Gunnar Ingelman and Anne L'Huillier, the Nobel Committee for Physics
Text: Joanna Rose
Translation: Peter Wennersten
Illustrations: ©Johan Jarnestad/The Royal Swedish Academy of Sciences
Editor: Sara Gustavsson

附件三

天文所研究團隊透過ALMA發現恆星雙胞胎形成過程

發稿時間：中華民國103年12月04日

本院天文所副研究員高桑繁久所領導的研究團隊藉天文望遠鏡阿塔卡瑪大型毫米及次毫米波陣列(Atacama Large Millimeter/ submillimeter Array，簡稱ALMA) 觀測，發現環繞於一對年輕原恆星周圍的微塵與氣體分子雲裡的旋臂狀結構，並觀察到周圍氣體流向原恆星。在宇宙中，雙恆星比比皆是，此項研究成果首度揭曉雙星誕生的生成機制，於11月20日發表於《天文物理學期刊》（The Astrophysical Journal, ApJ）。

恆星形成於星際間由氣體與微塵組成的分子雲。先前關於恆星形成研究多聚焦於質量近似太陽的單恆星如何形成，並已建立標準模型：星際間緻密凝結氣體雲因重力塌縮而在中央形成了原恆星；事實上先前研究已經發現了塌縮中的氣體雲如何提供物質給中央的原恆星，但主要都是在單一恆星的條件下。

相對於單一恆星，我們對雙恆星的誕生形成機制所知很少，但天文學界已知的是，質量近似於太陽的這類恆星大多是結伴誕生，超過半數的類太陽恆星都是雙胞胎恆星，因此，追溯雙恆星如何誕生的詳細機制在天文研究上益形重要。理論上，環繞在胚胎期雙恆星外有個盤面，它會朝盤中央餵養雙恆星寶寶，提供它們在長大期間所需要的塵埃氣體物質。雖然新近研究中有些已經看得到環繞在雙恆星寶寶周圍的「環雙星盤」(circumbinary disks)，但解析力和靈敏度不足，未能提供盤面氣體運動細部特徵的影像。

由高桑繁久博士所主導的天文所團隊先後使用SMA次毫米波陣列望遠鏡(SMA)與ALMA觀測距離地球460光年遠，位在金牛座的L1551 NE雙恆星。最新觀測結果顯示ALMA的觀測具有更好的解析力和靈敏度，是SMA的1.6倍和6倍，大幅超越此領域中先前所有研究的觀測結果。觀測是用波長0.9毫米的塵埃連續發射譜線來追蹤星際介質分布狀況；以及一氧化碳的分子發射譜線，經都卜勒效應計算後能得知氣體運動情形。L1551 NE 雙星系統裡的兩個新生恆星質量分別是太陽質量的0.67倍和0.13倍，兩個新恆星之間的距離是145AU（AU是天文單位，等於地球到

接次頁

太陽的距離：1.5 × 108 公里)。結果研究團隊發現了雙星周圍各自伴隨著一塊氣體團，及環繞雙星的「環雙星盤」，其盤面大小約 300AU，是海王星公轉軌道的 10 倍大。在這樣特徵相當詳盡的觀測下，環雙星盤的細節首度公諸於世。如圖一所示，環雙星盤由兩部份構成，南側環呈 U 形，北方的發射譜線則呈反 U 形，隆起於西北和東北向。

爲求能更進一步了解這些新發現的特徵及其物理意義，研究團隊爲 L1551NE 雙星系統形成機制構建了理論模型，見圖二右框(依此理論模型所製動態影片，由日本國立天文臺超級電腦”ATERUI’’運算製作提供）。ALMA 觀測到的南北側 U 形和反 U 形特徵（圖二左框），經雙旋臂模型加以數值模擬後皆可複製、重現，兩個旋臂分別源自兩個新生雙恆星而向外伸出。將觀測中實際看到一氧化碳分子發射譜線與理論預測的氣體運動加以比較探討後，團隊首次確認旋臂上的氣體轉速較快，而位於旋臂內側的氣體轉速則較慢，並呈現了朝中央恆星方向塌縮的跡象，亦即代表物質餵食成長中新生雙恆星的過程正在進行。研究結果表示，雙恆星會震動環繞在它周圍的環雙星盤，誘導物質朝向位在環中央的新生雙恆星塌縮，以餵養這對雙星寶寶長大，未來成長爲雙恆星。高桑博士表示：「在 ALMA 高解析度觀測下，傳回了雙恆星誕生現場的第一手即時影像，實爲前所未見。」

本次理論預測模型由日本法政大學松本倫明教授以超級電腦執行。松本教授表示：「ALMA 觀測顯示從盤面而來的氣體物質餵養新生雙恆星，這與理論預測符合程度驚人之高。」本研究共同主持人、日本國立天文臺的西合一矢博士說明：「本研究能夠以高精確度展現出環雙星盤結構和運動，須歸功於 ALMA 望遠鏡的高解析度和高靈敏度。隨著天文學界跨入了 ALMA 時代，高解析觀測加上詳盡數值模擬勢必越形重要。本次以 L1551 NE 爲主題的研究，綜合了 ALMA 觀測、理論模型、超級電腦運算，未來將成爲最新研究趨勢的重要參考。」

論文作者包括：中央研究院天文及天文物理研究所高桑繁久、日本國立天文台野邊山宇宙電波觀測所齋藤、日本國立天文台 ALMA 推進室西合一矢、日本法政大學松本倫明、日本千葉大學花輪知幸、香港大學林仁良、中央研究院天文及天文物理研究所賀曾樸。

這項研究計畫由臺灣科技部、香港政府與日本學術振興會科學研究費補助金的經費支持。

見背面

論文全文請參考《天文物理學期刊》網站：http://iopscience.iop.org/0004-637X/796/1/1/article

本論文雙恆星形成模式預測動畫由日本法政大學松本倫明博士製作：

http://redmagic.i.hosei.ac.jp/~matsu/tmp/L1551NE_v2/L1551NE_volren_rest.mp4

新聞聯繫人：

顏士韋博士，中央研究天文及天文物理研究所博士後研究，

hwyen@ asiaa.sinica.edu.tw (Tel) +886-2-2366-5429 (M) 0921-104832

黃復君，中央研究院院本部秘書長室，pearlhuang@gate.sinica.edu.tw

(Tel) +886-2-2789-8820 (M)+886-912-831-188

林美惠，中央研究院院本部秘書長室，mhlin313@gate.sinica.edu.tw

(Tel) +886-2-2789-8821 (M) +886-963-712-720

發稿單位 ： 秘書長室

最後更新：中華民國 103 年 12 月 04 日

接次頁

附件四

屠呦呦善用中醫智慧 靠青蒿素拿諾貝爾獎

（中央社台北5日電）大陸藥學家屠呦呦獲得諾貝爾醫學獎，她以青蒿素在抗瘧藥物上的創新研究，造福全球許多貧困地區的居民，也讓中醫在現代醫學的應用受到注意。

中國中央電視台報導，2011 年屠呦呦在獲得美國生物醫學重要獎項拉斯克獎後，其得獎感言表示，青蒿素的發現是中國傳統醫學給人類的一份禮物，開發傳統醫藥，將給世界帶來更多的治療藥物；她並呼籲開展全球合作，使中醫藥和其他傳統醫藥更能造福人類健康。

屠呦呦生於 1930 年，她在 1955 年考入中醫研究院，除了在實驗室做實驗，還曾結合歷代古籍和自己在各省採集樣本的經驗，完成「中藥炮炙經驗集成」的主要編著工作。

屠呦呦現為中國中醫研究院終身研究員兼首席研究員，青蒿素研究開發中心主任，投入青蒿素研究超過 40 年。漫長的研究生涯要回溯自 1967 年，而中醫古籍對她的研究有突破性影響。

1967 年大陸緊急啓動「瘧疾防治藥物研究工作協作」的大型專案，當時惡性瘧原蟲對老一代抗瘧藥已產生抗藥性，如何發明新藥成為世界性的棘手問題。

屠呦呦當時被任命為此專案的中醫研究院科研組長。她翻閱歷代本草醫書，四處走訪老中醫，然後在 2000 多種方藥中整理出一張含有 640 多種草藥、包括青蒿在內的「抗瘧單驗方集」。

她在西元 4 世紀東晉時期葛洪的著作「肘後備急方」中得到啓發，認為常用的水煎法會因為高溫破壞青蒿中的有效成分，因此採用低沸點溶劑進行實驗。

經過 190 次的實驗失敗，屠呦呦 1971 年在低沸點實驗中發現了抗瘧效果為 100%的青蒿提取物。1992 年，她又發明出雙氫青蒿素這一抗瘧療效為前者 10 倍的升級版

見背面

提取物。

//
中草藥抗瘧有所本 諾貝爾獎終於肯定

（中央社記者龍珮寧台北5日電）中國大陸學者屠呦呦發現抗瘧藥青蒿素，今天成爲第一個諾貝爾醫學獎肯定的中草藥學者，屠呦呦從中藥典得到靈感，從青蒿草提取抗瘧藥，填補另一抗瘧草藥奎寧的不足，造福世界。

陽明大學微生物及免疫學研究所教授陳正成專攻蟲媒生物傳染病，他說，在傳統中醫藥古方之中，早就有青蒿等中草藥治療瘧疾的紀錄。

陳正成指出，晉朝醫學家葛洪的中醫方劑學名著「肘後備急方」中有「青蒿一握，以水二升漬，絞取汁，盡服之」的抗瘧記錄。

陳正成指出，青蒿抓一把折枝，絞汁後就喝下去的紀載，給了屠呦呦線索，發現從新鮮的青蒿提取青蒿素，可以治療瘧疾。

在傳統中醫領域，認爲瘧疾是因瘧邪，在「內經」中稱爲瘧氣，神農本草經、本草綱目等中醫藥典籍記載，青蒿草有解熱、治寒、鎮痛等效果。

在屠呦呦發現青蒿素之前，抗瘧藥物只有奎寧，這兩種藥物都源自植物草藥。青蒿爲菊科植物黃花蒿，奎寧來自茜草科植物金雞納樹。

疾病管制署防疫醫師羅一鈞比較這兩種藥，奎寧容易使患者發生頭暈、耳鳴、心悸等副作用，而且常因爲患者出現抗藥性，導致治療失敗；相形之下青蒿素藥性溫和、有效可補其不足，降低患者死亡率。

試題隨卷繳回