【3.12】

**3.12每日一篇 | 外刊精读**

**neutrino** **astronomy**：Whizz-bang  
   
What could have generated the most **energetic** **neutrino** ever **detected**?  
   
【1】On February 13th 2023 an object with **extraterrestrial** **origins** went **screaming** through the Mediterranean Sea off the Sicilian coast. A single, super - **energetic** **subatomic** **particle** left a **sparkling** **trail** of light in the depths. And it did so right in the middle of an odd sort of **telescope** that was **partway** through **construction**. In a paper **published** in Nature this week, the scientists in charge of KM3NET discuss how they **detected** the **signature** of the most powerful **neutrino** that science has ever seen.Panda Foreign Magazine Intensive Reading:Respect for Originality, Piracy Must Be Punished  
   
【2】KM3NET is not a **conventional** **telescope**. It does not rely on **visible** light, as astronomers long have, nor on other bits of the **electromagnetic** **spectrum**, such as radio waves or **gamma** **rays**, that were added to their **arsenal** in the 20th century. Instead it **examines** the **universe** with neutrinos, **ghostly** but **omnipresent** **subatomic** **particles** that are produced in nuclear reactions. Scientists had theorised that very - high - energy neutrinos ought to exist, produced by **violent** **astronomical** processes such as **gamma** - **ray** **bursts** or matter falling into **giant** black **holes**. Now they have evidence that they were right.  
   
【3】Detecting neutrinos is difficult. They are **aloof** **particles** that rarely **deign** to **interact** with the rest of the **universe**. They feel only two of the four **fundamental** forces: the weak nuclear force, which works over very small distances, and **gravity**; they are immune to electromagnetism and the strong nuclear force. Trillions of neutrinos, mostly produced by the Sun, rain down on each square metre of Earth’s **surface** every second. The vast majority **sail** right through the planet.  
   
【4】Occasionally, though, one will **slam** **straight** into another **subatomic** **particle** inside an atom. That will produce a **shower** of secondary **particles** that are much easier to spot. A **neutrino** **telescope**, therefore, is a **giant** exercise in **statistics**. Observe lots of atoms for a long time and sooner or later you will see a **collision**. Detectors like Super Kamiokande, in Japan, or ICE Cube, in Antarctica, use huge **quantities** of **ultra** - pure water and ice **respectively**. The secondary **particles** produced by **neutrino** **collisions** produce **characteristic** **flashes** of light as they pass through the **detector**. KM3NET uses the Mediterranean Sea instead. Two groups of detectors sit several kilometres deep in the waters off Sicily and Toulon in France. (A third is planned near Pylos, in Greece.)  
   
【5】The **neutrino** from 2023 came in from the west, travelling almost **horizontally**. It passed through more than 100km of rock before **colliding** with something and generating a very **energetic** **muon**—a heavier cousin to the **electrons** that **surround** **atomic** **nuclei**. It was that **muon**, rather than the **neutrino** itself, that flashed through the **detector**. But by working **backwards**, the researchers were able to **tentatively** **conclude** that the **neutrino** that generated it was **packing** something like 220 petaelectron - **volts** of energy—in **layman**’s terms, about as much as a ping - pong ball dropped from a height of a metre.  
   
【6】The big question is what could have produced it. Fortunately, the neutrinos’ **reluctance** to **interact** with anything means they chart **straight** **paths** through space, **unaffected** by **magnetic** fields or clouds of gas. When KM3NET’s researchers went looking through **archived** **observations** of the **patch** of space from which the **neutrino** had come, they **spotted** a dozen “blazars”, **jets** of energy produced by matter falling into black **holes**, pointing **straight** at Earth. Any of those could have been the source.Panda Foreign Magazine Intensive Reading:Respect for Originality, Piracy Must Be Punished  
   
【7】But they are not sure: the **detection** was made while KM3NET was about only 10% complete, and there are other, less exciting, possible explanations. In future, scientists will be better prepared. An **automated** system, designed to **alert** other telescopes to **noteworthy** **neutrino** detections, was not working in 2023. Had it been, scientists could have quickly trained all manner of other **instruments** on the **relevant** **patch** of the sky, hoping to spot extra **clues**. That system should be up and running soon. All that can be done now is wait and hope that something similar happens again.

**①短语**

1.原文：It does not rely on visible light, as astronomers long have, nor on other bits of the electromagnetic spectrum

词典：rely on 依赖；依靠

例句：It would be rash to rely on such evidence.

依靠这样的证据太轻率了。

2.原文：they are immune to electromagnetism and the strong nuclear force

词典：be immune to 对……免疫

例句： He was so stubborn that he was immune to all suggestions.

他太固执了，根本不听任何建议。

3.原文：Observe lots of atoms for a long time and sooner or later you will see a collision.

词典：sooner or later 迟早

例句：Sooner or later you will have to make a decision.

你早晚得拿个主意。

4.原文：It passed through more than 100km of rock before colliding with something and generating a very energetic muon

词典：collide with 与……相撞

例句：The aims of the negotiators in New York again seem likely to collide with the aims of the warriors in the field.

纽约谈判者的目标看起来可能再次与战场上勇士们的目标相冲突。

5.原文：the neutrino that generated it was packing something like 220 petaelectron - volts of energy—in layman’s terms, about as much as a ping - pong ball dropped from a height of a metre

词典：as much as 与……一样多；和……一样喜欢；几乎但并非完全

例句：Temperatures can fluctuate by as much as 10 degrees.

温差可达10度之多。

6.原文：Fortunately, the neutrinos’ reluctance to interact with anything means they chart straight paths through space, unaffected by magnetic fields or clouds of gas.

词典：reluctance to 不情愿

例句：Troops were displaying an obvious reluctance to get involved in quashing demonstrations.

部队明确表示不愿卷入镇压示威活动。

7.原文：That system should be up and running soon.

词典：be up 到了，结束了；起床

例句：Our system should be up by this afternoon.

到今天下午，我们的电脑系统应该运行起来了。

**②长难句**

原文：It does not rely on visible light, as astronomers long have, nor on other bits of the electromagnetic spectrum, such as radio waves or gamma rays, that were added to their arsenal in the 20th century.

分析：这个句子的核心结构是It does not rely on visible light，其中A是visible light，B是other bits of the electromagnetic spectrum。主语It指代某种天文学观测方法或技术，谓语does not rely on说明它不依赖于某些物理现象，nor连接了并列成分，表示否定并列关系，即 “既不依赖 A，也不依赖 B”。B进一步由 “such as radio waves or gamma rays” 进行举例，说明other bits of the electromagnetic spectrum具体包括无线电波和伽马射线。最后，that were added to their arsenal in the 20th century” 是一个定语从句，修饰 “other bits of the electromagnetic spectrum”。

译文：它既不借助天文学家长期依赖的可见光，也不利用20世纪被纳入观测手段的电磁波谱其他部分，比如无线电波或伽马射线。

原文：When KM3NET’s researchers went looking through archived observations of the patch of space from which the neutrino had come, they spotted a dozen “blazars”, jets of energy produced by matter falling into black holes, pointing straight at Earth.

分析：这个句子的主句是they spotted a dozen “blazars”，其中they是主语，spotted 是谓语，a dozen “blazars”是宾语。句首When KM3NET’s researchers went looking through archived observations...是时间状语从句，修饰主句，表示研究人员发现耀变体的背景。宾语a dozen“blazars”后面跟着同位语jets of energy...，解释耀变体的本质，而pointing straight at Earth是现在分词短语，进一步描述这些耀变体的方向。

译文：当KM3NeT的研究人员回溯该中微子来源方向的太空区域，查阅存档的观测数据时，他们发现了十几个“耀变体”。这些耀变体是由物质坠入黑洞后产生的能量喷流，它们正好直接指向地球。

**③写作技巧**

Had it been, scientists could have quickly trained all manner of other instruments on the relevant patch of the sky, hoping to spot extra clues.

如果当时该系统已投入运行，科学家们就能迅速调动各种其他仪器对准相关天区，期望能发现更多线索。

句中Had it been是一种倒装结构，用于表示与过去事实相反的假设（即虚拟语气）。它等价于If it had been，但省略了if并采用倒装形式（即把助动词had提前）。这种用法在书面语或正式文体中较常见，增强表达的正式感或文雅感。

例句：

Had she known about the meeting, she would have attended.

（= If she had known about the meeting, she would have attended.）

如果她知道有这个会议，她本来会参加的。

Had they left earlier, they wouldn’t have missed the flight.

（= If they had left earlier, they wouldn’t have missed the flight.）

如果他们早点出发，就不会错过航班了。

Had I studied harder, I could have passed the exam.

（= If I had studied harder, I could have passed the exam.）

如果我当时更用功，我本可以通过考试。

**④背景知识**

中微子（Neutrino）：一种质量极小、不带电的亚原子粒子，仅通过弱核力和引力与其他物质发生相互作用，因此极难被探测。中微子广泛存在于宇宙中，由核反应、超新星爆炸、黑洞吸积等高能天文事件产生。

μ子（Muon）：一种不稳定的带负电基本粒子，属于轻子家族，与电子类似，但质量约为电子的207倍。μ子通常由高能粒子碰撞或宇宙射线作用产生，能量较高且穿透力极强，可在探测器中留下可观测的轨迹。

KM3NeT（千米立方中微子望远镜）：一个位于地中海深海中的中微子望远镜网络，主要用于探测来自宇宙深处的高能中微子。KM3NeT由多个分布在海底的光学传感器阵列组成，利用海水作为探测介质，通过观察中微子与水分子相互作用后产生的切伦科夫辐射来研究高能天体物理现象。

**⑤段落大意**

【1】背景介绍：2023年2月，KM3NeT探测到来自外太空的超高能中微子

【2】探测工具：KM3NeT通过中微子探测宇宙，验证了极高能量中微子的存在

【3】中微子特点：中微子几乎不与物质互动，每秒有数万亿个穿过地球

【4】探测方式：中微子碰撞产生次级粒子，KM3NeT通过海底探测器捕捉信号

【5】μ子产生：2023年中微子穿透岩石后产生高能μ子，能量相当于乒乓球掉落

【6】源头猜测：科学家追踪到耀变体可能是中微子的源头，但尚未确认

【7】未来发展：KM3NeT计划启用自动预警系统，以提升未来探测效率