

《科学美国人：黄金从何而来你知道吗？可能来自一场宇宙大灾难》



That ring on your finger made of platinum or gold contains a secret that has been at the center of a cosmic mystery.

你手指上戴的白金或黄金戒指，蕴含着一个一直处于宇宙奥秘中心的秘密。

Scientists have been combing the galaxy to figure out where these so-called "heavy elements" come from.

科学家们一直在梳理银河系，以搞清楚这些所谓的“重金属元素”从何而来。

Lighter elements—everything from helium, with its two protons per atom, on up to iron, which has 26 protons in each nucleus—are better understood.

人们对所有较轻的元素基本都理解透彻了——从每个原子有两个质子的氦到每个原子核有26个质子的铁。

Most of these form inside stars.

他们大部分是在恒星内部形成的。

But our knowledge gets fuzzy after iron.

但我们所了解到的知识，直到铁元素后，就都是谜团了。

Gold, which has 79 protons in each atom, can't be made that way.

金的每个原子含有79个质子，不能用这种恒星聚变方式形成。

The same goes for platinum, xenon, radon and many rare Earth elements.

铂、氙气、氡和许多稀土元素也是如此。

For decades scientists theorized where these "heavy metals" came from and how they arrived on Earth.

几十年来，科学家一直在研究这些“重金属”从何而来，以及它们是如何到达地球的。

The leading idea was an extremely violent cosmic event—a collision between two neutron stars.

有一种主流思想是这些重金属来源于一种极其猛烈的宇宙事件——两颗中子星之间的碰撞。

Until recently this was just a theory—but that changed a few years ago,

直到最近，这还只停留在理论上，但几年前情况发生了变化，

when scientists detected gravitational waves from such a crash—and saw light at the same time.

当科学家探测到来自这样一次碰撞的引力波，同时看到了光。

This light held the chemical signatures of these heavy elements—offering the first evidence supporting the theory of where they came from.

这束光拥有这些重元素的化学特征，为支持它们来源的理论提供了第一个证据。

It also helped scientists fill in some of the details of how this process might work.

它还帮助科学家们填写了这一过程可能如何工作的一些细节。

Neutron stars are the densest things in the universe except for black holes.

除了黑洞，中子星是宇宙中密度最大的物质。

They are born when heavy stars die and their cores collapse.

它们是在重恒星死亡和其核心坍塌时诞生的。

The incredible gravitational pressure squishes the atoms together, protons and electrons smush, all leaving a star almost entirely made of neutrons.

令人难以置信的引力将原子挤压在一起，质子和电子碎裂，留下了一颗几乎完全由中子组成的恒星。

In the rare case when two neutron stars slam together—the explosion creates mind-blowing temperatures and pressures.

在罕见的两颗中子星相撞的情况下，爆炸产生了令人震惊的温度和压力。

It also pumps out a lot of free neutrons—up to a gram of neutrons spills into every cubic centimeter of space.

它还释放出大量的自由中子——每立方厘米的空间中就会溢出多达一克的中子。

These rare conditions ignite what's called the rapid neutron-capture process, otherwise known as "R-process" for short.

这些罕见的条件引发了所谓的快速中子捕获过程，也就是简称为“R-过程”。

It all starts with a seed nucleus, such as iron.

这一切都始于种子核，例如铁。

The iron nucleus starts out with 26 protons and around 30 neutrons.

铁原子核开始时有26个质子和大约30个中子。

But during the R-process, it will quickly capture many more neutrons in a matter of milliseconds.

但在R过程中，它将在几毫秒内迅速捕获更多的中子。

The new nucleus is highly unstable because of its lopsided quantity of neutrons, so some of the neutrons will decay into protons.

新原子核由于其中子数量的不平衡而高度不稳定，因此一些中子将衰变为质子。

The result of this extremely fast, complex process is a new form of matter.

这一极其快速、复杂的过程的结果，是产生了一种新的物质形式。

Just think, that piece of gold on your finger—every bit of it started off in a cosmic cataclysm that is among the most violent and powerful forces in the universe.

想想看，你手指上的那块金子，它的每一点都始于一场宇宙大灾难，这是宇宙中最暴烈、最强大的力量之一。

A cosmic mystery on the way to being solved, and a piece of the universe, all in the palm of your hand.

一个正待解开的宇宙之谜，一个宇宙的碎片，都在你的手掌中。

重点词汇

made of 制成；“make certain”的变体

has been 已经

have been 来过

figure out 解决；算出；想出；理解；断定

come from 来自；出生于；出身于

that way 那边

heavy metals 重金属摇滚乐；重金属；heavy metal的复数

and how <美>非常，很