experimentalists have announced the state's discovery before. In 2002, one collaboration claimed to have found a bound tetraneutron[2] in an experiment based on the detection of neutron clusters formed by fragmentation of beryllium-14 projectiles. But the result remains unconfirmed, and theorists quickly showed that, based on the best knowledge of the nucleon–nucleon interactions and other arguments[3,4], the existence of a bound tetraneutron was nearly impossible.

However, theorists could not rule out the existence of a tetraneutron as a short-lived 'resonant' state on the basis of a dineutron–dineutron structure[3,4]. The dineutron state is formed by two neutrons, and is not stable. It is known as a virtual state: if its energy were reduced by 66 keV, then the dineutron system would become bound. Decades earlier, it had been proposed[5] that dineutrons can become bound in the presence of additional nucleons; this mechanism is responsible for the properties of some bound nuclei that have a neutron excess, such as lithium-11, in which a pair of external neutrons forms a remote halo around the core of lithium-9.

The tetraneutron cannot form an atomic nucleus because it is charge neutral and therefore cannot hold electrons. But there is an intimate relationship between the tetraneutron structure and theoretical studies of neutron stars (Fig. 1), in which neutrons are compressed to densities more than 10^{14} times that of water[6]. They are prevented from imploding by an outward pressure that is generated by the nucleon–nucleon interaction and other quantum-mechanical effects.

Nuclear physicists hope to develop a full understanding of how quarks and gluons inside nucleons generate nucleon–nucleon forces, and how many-body objects evolve to form complex structures such as the uranium nucleus and neutron stars. This is a formidable task, with well-understood parts but also many missing links. If Kisamori and co-workers' report of the tetraneutron state is confirmed, even as a short-lived resonance, it will add another structure to the nuclear chart that will help to improve our understanding of the nuclear interaction. ■

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1. Kisamori, K. *et al. Phys. Rev. Lett.* **116,** 052501 (2016).
2. Marqués, F. M. *et al. Phys. Rev. C* **65,** 044006 (2002).
3. Bertulani, C. A. & Zelevinsky, V. *J. Phys. G* **29,** 2431–2437 (2003).
4. Pieper, S. C. *Phys. Rev. Lett.* **90,** 252501 (2003).
5. Migdal, A. B. *Sov. J. Nucl. Phys.* **16,** 238–241 (1973).
6. Shapiro, S. L. & Teukolsky, S. A. *Black Holes, White Dwarfs, and Neutron Stars* (Wiley, 1983).

This article was published online on 6 April 2016.

NEUROSCIENCE

Fault tolerance in the brain

If stored information is erased from neural circuits in one brain hemisphere in mice, the lost data can be recovered from the other. This finding highlights a safeguarding mechanism at work in the brain. SEE ARTICLE P.459

BYRON M. YU

When we send an e-mail or save a file on our hard drives, information can be lost, owing to dropped data packets or corrupted bits. We typically do not notice such failures because systems are designed with built-in mechanisms to restore the lost data. Dropped packets are retransmitted, and multiple copies of data are saved. The brain also stores and transmits information — is it, too, fault-tolerant? In this issue, Li *et al.*[1] (page 459) report the perturbation of brain activity to erase stored information in mice. They discover that the lost information can be rapidly restored by an unperturbed brain region.

The brain can reorganize itself to restore function after certain types of injury[2], but this type of fault tolerance typically takes place over weeks. By contrast, many everyday brain functions, such as putting a name to the face of an acquaintance or hitting a tennis ball, take place on a timescale of seconds or less. Does a fault-tolerance mechanism also operate in neural circuits over these shorter timescales?

Li *et al.* investigated whether regions present in each of the brain's two hemispheres might act together to produce a rapid back-up system for stored information — a mechanism

50 Years Ago

Hypnotic Susceptibility. By Ernest R. Hilgard — A large number of studies designed to investigate various hypnotic phenomena have been carried out by Ernest Hilgard and his co-workers on a considerable number of college students during the past eight years. Individual differences in 'hypnotizability' have been a major area of interest and in the course of their investigations several scales were developed for the quantitative assessment of hypnotic susceptibility … There are three general purpose scales and a scale for yielding profiles of hypnotic ability. Convincing statistical evidence is given concerning their validity and reliability … The latter part of the book is concerned with the relation of hypnotic susceptibility to a number of personality variables … Although some significant correlations do emerge, they are insufficient to characterize the hypnotizable person clearly.
From *Nature* 30 April 1966

100 Years Ago

The large meteors which passed over Northern America on February 9, 1913, presented some unique features. The length of their observed flight was about 2600 miles, and they must have been moving in paths concentric, or nearly concentric, with the earth's surface, so that they temporarily formed new terrestrial satellites … The meteors were last seen from the Bermuda Islands … I have since made efforts to obtain further observations from seafaring men through the medium of the *Nautical Magazine*, and have succeeded in procuring data which prove that the meteors were observed during a course of 5500 miles from about lat. 51° N., long. 107° W., to lat. 5½° S., long. 32½° W.
From *Nature* 27 April 1916

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