

Sciencewatch

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Physics and wealth inequality

Wealth inequality, a topic of much current concern, is an inevitable consequence of the laws of physics. That's the conclusion of a study by Adrian Bejan of Duke University in the US and Marcelo Errera of the Federal University of Paraná in Curitiba, Brazil, who have related the distribution of wealth to what they call "the movement of all streams" of a live society. This corresponds to the actual physical movement of masses over distances and can be defined in various ways, such as the amount of fuel consumed annually, all of which lead to the same



The new study reveals why inequality is so difficult to erase.

scaling behaviour. This naturally produces a hierarchical distribution of wealth that becomes more accentuated as the economy develops, and predicts the Lorenz-type distribution of wealth that has been adopted empirically for the last century.

● Further reading

A Bejan and M Errera 2017 *J. Appl. Phys.* **121** 124903.

Negative mass

Push most objects and they will accelerate in the direction they were pushed. Not so for objects with a negative effective mass, which do the exact opposite by accelerating against an applied force. This counter-intuitive behaviour has now been realised experimentally in an expanding Bose–Einstein condensate made from rubidium atoms. Mohammad Khamsehchi of Washington State University and colleagues engineered a specific dispersion relation in the system using Raman dressing techniques to open a gap at the crossing of two parabolic free-particle dispersion curves. For suitable parameters this leads to a branch with a region of negative curvature, and thus a negative effective mass. The team reports a range of interesting dynamics in the system, including breaking of parity and Galilean covariance, dynamical instabilities and self-trapping.

● Further reading

M Khamsehchi *et al.* 2017 *Phys. Rev. Lett.* **118** 155301.

Big chemistry

Expensive, large-scale projects are familiar in physics, astronomy, space exploration and, more recently, genetics. Now chemistry may join the ranks of big science. Martin Burke of the University of Illinois, Urbana-Champaign, has proposed a \$1 billion, 20 year-long project to extend an automated synthesis machine such that it can synthesise most of the hundreds of thousands of known organic small molecules made by plants, animals and microbes – many of

Blood in amber

In what seems like a step closer to Jurassic Park, combined with some good fortune, a blood-engorged tick trapped in amber 15–45 million years ago has turned out to contain perfectly preserved mammalian blood cells, likely from a monkey. George Poinar Jr of Oregon State University in Corvallis also found numerous single-celled parasites in different parts of their life cycle in the fossil, which comes from the Cordillera Septentrional mountain range of the Dominican Republic. Two small holes on the tick's back suggest that it was picked off during its meal, perhaps by another monkey, and fell immediately into tree sap. As an added bonus, the amber stained the red blood cells and parasites differently, making each stand out clearly.

● Further reading

G Poinar Jr 2017 *J. Med. Entomol.* doi:10.1093/jme/tjw247.



The preserved tick, measuring roughly 2 mm across, with two broken areas visible in the body wall.

which are of medical interest. The odds of funding for such a project at present are not clear, but it is certainly a bold new idea.

● Further reading

R Service 2017 *Science* **356** 231.

AI identifies bias

Machine learning applied to ordinary English can identify content corresponding to human biases, according to a new study. Aylin Caliskan of Princeton University and colleagues used a word-embedding method that represents each word in a 2.2 million-word case-sensitive vocabulary as a vector with 300 semantic dimensions, derived from 840 billion "tokens" obtained from crawling the web. The method was able to distinguish human attitudes including likes, dislikes and stereotypes, potentially adding a new "comprehension" skill to computers. The result could lead to new understanding and detection of (perhaps unintended) discrimination based on factors such as race, gender, age or ethnicity.

● Further reading

A Caliskan *et al.* 2017 *Science* **356** 183.

Condensed-matter SUSY

While supersymmetry has not yet appeared at the Large Hadron Collider, a new analysis predicts that it should appear as an emergent phenomenon in condensed-matter physics. Shao-Kai Jian of Tsinghua University in China and colleagues have shown that a supersymmetric gauge theory with dynamical gauge bosons and fermionic gauginos emerges under certain conditions on the surface of a correlated topological insulator, such as SmB₆.

● Further reading

S-K Jian *et al.* 2017 *Phys. Rev. Lett.* **118** 166802.

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