HUMAN MOBILITY

People's potential

Nat. Commun. **10**, 3895 (2019)

Credit: Alex Segre / Alamy Stock Photo

Commuter flows in cities are regular and predictable. This should come as no surprise to anyone who has witnessed crowds jostle for space on a city-bound train platform in the morning. A widespread approach to capture these regularities mathematically considers flows in gravitational terms, where people behave as masses. However, its somewhat ad-hoc nature has made researchers look for alternatives.

Mattia Mazzoli and co-workers have now revealed that the gravitational picture is more rigorous than it may seem. From Twitter and census data, they divided several cities into 1×1 km^2 cells and constructed an empirical vector field pointing in the average direction of commuter flow for each cell. Such a vector field was shown to satisfy the divergence theorem and have vanishing curl. This made it possible to rigorously define a potential field, reducing the dimensionality of the problem and highlighting basins of attraction, offering help for urban planning. *FL*

https://doi.org/10.1038/s41567-019-0689-z

BIOMATERIALS

Mighty maze

J. R. Soc. Interface **16**, 20190175 (2019)

Cuttlefish are unique among their present-day cephalopodic peers in that their shell comprises chambers supported internally by a labyrinth of pillars. An imaging analysis conducted by Charles Le Pabic and co-workers now suggests that the early development of this structure is optimized to offer the organism both robustness and buoyancy.

The authors used CAT-scan images to examine the way that the chamber dimensions and the properties of the pillar network varied across the embryonic, juvenile and adult stages of a cuttlefish's life. They found that the internal structure evolved from a set of isolated pillars to a complex network, becoming fully connected just weeks before the organism embarked on an autumnal migration through deep waters.

This timely completion cements the network's established role in withstanding hydrostatic pressure. But the authors' measurement of a concomitant increase in network tortuosity also hints at a mechanism for buoyancy regulation, which is known to be governed by the distribution of liquid within the chambers. *AK*

https://doi.org/10.1038/s41567-019-0687-1

RESEARCH DIRECTIONS

One death at a time

Am. Econ. Rev. **109**, 2889–2920 (2019)

Does science advance one death at a time, as Max Planck famously quipped? Studies have already confirmed that when a 'star scientist' passes away, their collaborators produce work at a slower rate. Now, Pierre Azoulay and collaborators have comprehensively analysed the response of scientists who did not collaborate with the star researcher before their death.

In contrast to the collaborators' dip in productivity, the non-collaborators showed a marked increase in publications in the subfield previously dominated by the star. The strongest increase is from new entrants to the subfield.

It seems that younger scientists are put off working in a subfield when it is dominated by a 'big beast', even though they clearly have substantial contributions to make. While this 'gatekeeping' effect of eminent scientists may have some positive effects, it is an interesting question to think about whether the obvious down sides can be mitigated. *DA*

https://doi.org/10.1038/s41567-019-0688-0

SUPERSOLIDS

The buried trace

Nature https://doi.org/dbh7 (2019);
Nature https://doi.org/dbh8 (2019);
Phys. Rev. Lett. **123**, 050402 (2019)

A supersolid is a phase of matter possessing the seemingly incompatible properties of crystalline order and superfluidity. The crystal structure breaks the continuous translational symmetry, giving solids mechanical stability. Superfluidity breaks the global gauge symmetry, leading to a coherent, macroscopic behaviour of quantum particles. Consequently, persistent and dissipationless flow can exist. These two spontaneously broken symmetries are the smoking gun of the supersolid phase, and now Luca Tanzi and co-workers, Mingyang Guo and co-workers, and Gabriele Natale and co-workers have reported the observation of their signatures.

Breaking the two continuous symmetries causes the emergence of two gapless excitations. In harmonically trapped systems, however, only the collective modes with finite excitation energies can be observed. To characterize the supersolid phase realized in a trapped dipolar quantum gas of magnetic lanthanide atoms, the teams explored several specific collective modes and their relation to the two broken symmetries. Based on that they could identify the emergence of the supersolid phase and its transition to other phases. *YL*

https://doi.org/10.1038/s41567-019-0691-5

GALACTIC EVOLUTION

Star age

Astron. Astrophys. **629**, A62 (2019)

In a star, the ratio of elemental abundances of carbon to nitrogen depends on its evolution. Because the relative abundance of carbon to nitrogen in the stellar surface is related to the stellar mass, which for red giants is sensitive to the star's age, it gives an estimate of stellar age — telling us more about the formation of a galaxy. However, ages of individual red giants are poorly constrained.

Giada Casali and colleagues have now reported an empirical relationship between the carbon-to-nitrogen abundance ratio in a star and its age for red giants observed with the Gaia-ESO and APOGEE spectroscopic surveys. The stars in the thin galactic disk were shown to typically be younger than those in the thick disk, confirming previous results. The data indicate that the disk evolved from the inside to the outside, and that the metal-rich stars in the inner thin disk formed at later stages of the galactic evolution. With the derived empirical formula, the age of red giants can be determined more precisely. *SR*

https://doi.org/10.1038/s41567-019-0690-6

David Abergel, Abigail Klopper, Federico Levi, Yun Li and Stefanie Reichert