ASTROPHYSICS

Move over Milky Way

Astron. J. **151,** 52 (2016)

The Milky Way is a sight to behold, especially on a dark night on top of a volcano. However, what if you want to view the galaxies behind it, in the region known as the zone of avoidance? Then the bright band of stars leads to 'stellar confusion', obscuring optical and infrared telescopes. But the 21-cm H I transition lines from neutral hydrogen gas suffer no such obscuration, so Lister Staveley-Smith and co-workers have successfully used the Parkes radio telescope in Australia to peer through the Milky Way. They detected 883 galaxies, including 254 that were previously unknown.

Beyond the Milky Way lies the Great Attractor, a gravitational anomaly that is expanding non-uniformly. It is also drawing our Galaxy, as well as the neighbouring Andromeda galaxy. We know superclusters of galaxies lie in the region. Wider area and deeper scans will help build a detailed map of the local structure to improve our understanding of the source of the gravitational attraction. *MC*

SURFACE SCIENCE

Condensed melt

Proc. Natl Acad. Sci. USA **113,** 1749–1753 (2016)

Ice surfaces are almost always covered with a thin layer of liquid water, even when the ice's temperature is below 0 °C. These quasi-liquid layers, as they are called, govern a range of surface-melting phenomena pertaining to various themes like meteorology, food conservation and winter sports. Little is known about the structure and the formation of the liquid layers, however. Harutoshi Asakawa and colleagues have now studied quasi-liquid layers by means of a combination of laser confocal microscopy and differential interference contrast microscopy.

The authors grew single crystals of ice on an AgI crystal, and put them in a chamber where the crystals' temperature and the partial pressure of the water vapour could be controlled. They found that two different types of morphologies for liquid layers occur: round, isolated drops (α-phase) and liquid films (β-phase). An investigation of the critical partial pressure above which the liquid phases developed, for various sample temperatures, revealed that supersaturation is required for the α- or β-phase to form. These phases are therefore thermodynamically metastable and do not form by melting of the ice below, but through condensation of the supersaturated gas phase above. *BV*

QUANTUM OPTICS

Automated experimentalist

Phys. Rev. Lett. (in the press); preprint at http://arxiv.org/abs/1509.02749

Engineering complex quantum states requires complicated experimental set-ups. Take quantum optics, for example: to create high-dimensional multiparticle entanglement one must carefully arrange numerous optical components in the correct order. Anyone who has seen a crowded optical table will appreciate that it takes skill and experience to design such experiments and the way to optimize them is not obvious. But where humans may fail, machines can help.

Mario Krenn and colleagues created a clever algorithm to help explore the possible ways of generating a desired quantum state using given building blocks such as beamsplitters, half-wave plates or Dove prisms. Starting with a random combination, the resulting quantum state is calculated and analysed. If it satisfies the required criteria, the set-up is then simplified and added to the toolbox — otherwise the search continues.

The algorithm learns from experience by adding the useful solutions to its toolbox, speeding up the search significantly. This automated exploration reveals useful but quite unusual techniques, previously unknown to human experimentalists, hinting at unconventional and rather unintuitive approaches to experiment design. *IG*

TREE PHYSICS

The answer to everything

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The increased frequency and severity of storms expected from global temperature rises could have a dramatic impact on both umbrella usage and tree populations. As storm data amasses, it seems that there is a critical wind speed that damages trees, regardless of the size or type. Emmanuel Virot and colleagues have provided insight into the physical origin of these somewhat counterintuitive observations.

Experimenting with beams of beechwood, Virot *et al.* showed that there is a critical radius of curvature that is needed to snap a wooden beam, which depends on the diameter and length, but not really on the elastic properties. And as there is a general relationship between a tree's height and its diameter — with a few assumptions — the critical wind speed can be written in a form that is dependent only on the tree's height.

But as this dependence is fairly weak, with the critical speed increasing by just 9% when the tree height is doubled, the critical wind speed at which trees break is roughly constant at 42 m s^{-1} — a value surely appreciated by fans of Douglas Adams. *LF*

Written by May Chiao, Luke Fleet, Iulia Georgescu, Abigail Klopper and Bart Verberck.

MATERIALS PHYSICS

Bumper harvest

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What do you get when you cross a beetle with a cactus? If your guess was an optimal water harvester, you're on the money. Kyoo-Chul Park and colleagues have exploited natural design principles to come up with a technique that outperforms existing technologies for rapid droplet growth and delivery.

Namib desert beetles are adept at collecting water on their backs. But whereas much has been made of their surface chemistry, their shape — characterized by a back covered in bumps — has been largely overlooked. Park *et al.* demonstrated that this bumpy surface facilitated optimal condensation by constructing a biomimetic device. The rapid growth of the droplets was complemented by a refinement inspired by the spines of cacti: the apex geometry of the bumps was tuned to ensure fast directional transport while maintaining an optimal growth rate. These geometrical tricks were made even more efficient with a nanocoating technique motivated by the slippery surface of the pitcher plant.

The device can even operate in the presence of a temperature gradient, meaning its impressive growth and turnover rates may be applicable to water harvesting in regions subject to extreme climatic conditions. *AK*