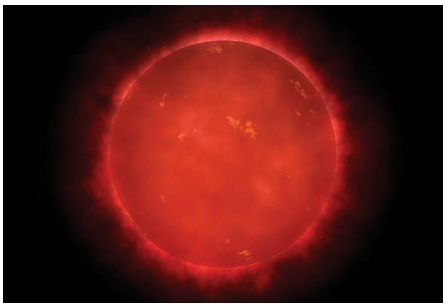
EXOPLANETS

Star companions

Astron. Astrophys. **627**, A49 (2019)



Credit: NASA/Walt Feimer

When we gaze at the northern celestial hemisphere, we might observe a few stars of the Aries constellation. But many stars go unnoticed with the naked eye, such as the red dwarf Teegarden's Star (pictured). Red dwarfs are much cooler than other stars, and are the most common type of star in the Milky Way. But despite their prevalence, only a few planets have been observed in the vicinity of red dwarfs.

Mathias Zechmeister and colleagues found two exoplanet candidates orbiting Teegarden's Star. Radial-velocity measurements of the red dwarf were taken with the visual and near-infrared spectrographs of the CARMENES instrument. The data revealed two signals with periods of a few days, which are best explained by the Keplerian motion of two exoplanets. The minimum mass of the planet candidates is close to that of the Earth, and if the planets are made of rock, their expected radii are also similar to Earth's radius — they might even be habitable. *SR*

https://doi.org/10.1038/s41567-019-0639-9

FLUID DYNAMICS

Love–hate liquids

Phys. Rev. Fluids (in the press)

The 'ouzo effect' refers to the stable microemulsion that forms when anise-based liqueur is mixed with water. And it can be understood as something of a love triangle: the anethole and ethanol in ouzo are miscible, and ethanol plays well with water, but the third pairing is antagonistic, resulting in that familiar milky emulsion. Oscar Enríquez and colleagues have captured the dynamics of a water droplet introduced into the bottom of a mixture of anise oil and ethanol in a video shown in the Gallery of Fluid Motion (https://doi.org/c8gb).

Water dissolves slowly in pure anethole and mixes rapidly with ethanol. But in mixtures comprising at least two parts anethole to one part ethanol, the authors witnessed pronounced oscillations on the water's surface. The oscillations were likely due to Marangoni stresses induced by spatial variation in the mixture's composition, which were responsible for an accumulation of oily microdroplets within water–ethanol droplets in another study conducted by Huanshu Tan and co-workers (*J. Fluid Mech.* **870**, 217–246; 2019). *AK*

https://doi.org/10.1038/s41567-019-0636-z

NONLINEAR OPTICS

Quantum Hall polaritons

Nature https://doi.org/c8gc (2019)

Polaritons are particles made up of light and electrons, and can be used to enhance the coupling between photons via the electronic interactions. Patrick Knüppel and collaborators have shown that the interaction between polaritons in a two-dimensional electron gas embedded in an optical cavity can be substantially increased if the electronic part of the polaritons is in a fractional quantum Hall state. This leads to a strong nonlinear optical response.

The authors observed an increase in the reflected third harmonic of the incident light when the electrons were at filling fractions 2/3 and 2/5. This suggests that nonlinear spectroscopy can be used to investigate strongly correlated materials in addition to traditional linear spectroscopy and transport techniques. Also, the 'polariton blockade' regime — where the interactions shift the resonance condition by more than the linewidth so that the presence of a polariton blocks the injection of a second one — might now be within reach. *DA*

https://doi.org/10.1038/s41567-019-0637-y

BIOMIMETICS

The best of both eyes

Adv. Funct. Mater. **29**, 1903340 (2019)

Naturally evolved eyes have their strengths and weaknesses. Compound eyes allow insects to see over a wide range of angles, but the fixed focal length limits resolution and depth perception. Vertebrate eyes, on the other hand, are varifocal but have a small field of view. Zhuo-Chen Ma and colleagues have combined the two principles and made an artificial compound lens with variable focal length.

The lens comprises approximately 80 individual facets arranged in a hexagonal pattern — similar to a dragonfly eye — and was fabricated from the protein bovine serum albumin using direct laser lithography. The protein reacts to a change in the pH value of its environment by swelling or shrinking and therefore with a change of focus and of the viewing angle. But when the team placed the lens on top of a polymer dome, whose shape stayed unaltered, the field of view remained constant while the focus was adjusted. *NM*

https://doi.org/10.1038/s41567-019-0638-x

QUANTUM GASES

Virtually cold

Phys. Rev. X (in the press); preprint at https://arxiv.org/abs/1812.02175

Reaching temperatures that are low enough to observe many predicted quantum phases is challenging, even with today's state-of-the-art techniques. This obstacle is one of many preventing the study of extremely low-temperature phenomena with quantum simulators. To overcome this difficulty, Jordan Cotler and co-workers have now proposed a scheme that allows access to low-temperature physics without the need to actually reach the low temperature physically. They dub this technique 'virtual cooling'.

The central idea explored by the scheme is the link between the density matrix of a system at low temperature and the higher power of the density matrix of the same system at high temperature. The authors showed that the higher power can be accessed through operations involving the exchange of multiple copies of the system. In cold-atom experiments, this is achievable by collective measurements. As an experimental demonstration, the scheme was implemented in a Bose–Hubbard model. Expectation values of an observable at half the temperature of the physical system were derived. *YL*

https://doi.org/10.1038/s41567-019-0640-3

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