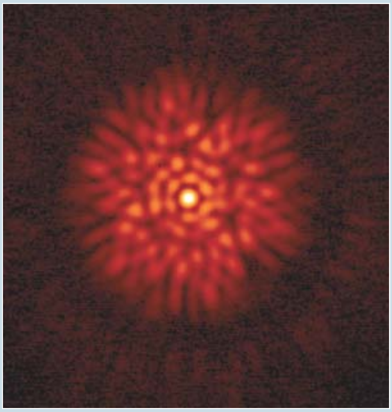
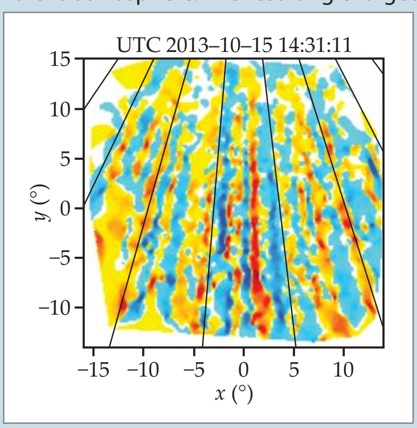
Young stars with brown dwarfs. Because most nearby stars are old, studying young planetary systems entails looking beyond the solar neighborhood. Sasha Hinkley of the University of Exeter in the UK and his collaborators are using two of the world's largest optical telescopes, the Keck II in Hawaii and the Very Large Telescope in Chile, to do just that. Their hunting ground is the Scorpius–Centaurus Association, a region of ongoing star formation 10 million to 20 million years old and 400 light-years away. At that distance, an object 10–100 times the mass of Jupiter (M_J) is still bright enough to be detected directly—provided its orbit is 30 astronomical units (AU) or wider. Closer orbits hit the telescopes' diffraction limits. To search for those close-in objects, Hinkley and his collaborators use aperture mask interferometry. An opaque mask with a set of 7 or 9 holes is placed in the telescope's pupil. The collection of holes generates interference patterns, such as the one shown here, that encode a range of angular distances. In their pilot study, the researchers targeted 140 stars whose masses range from 1.5 to 4.5 solar masses. When observed with the mask, six stars turned out to have companions; one has two companions. None of the companions are planets: Four are small red stars, and three are brown dwarfs—substellar objects whose masses are too low to initiate hydrogen fusion. For stars of the targets' mass and age, no companions with the same combination of mass (20–200 M_J) and orbital separation (10–30 AU) have ever been observed before. (S. Hinkley et al., *Astrophys. J. Lett.* **806**, L9, 2015.) —CD



Imaging Earth's plasma ducts. For many decades, researchers have known that the Sun's light ionizes the upper reaches of Earth's atmosphere. The resulting charged particles in the ionosphere—and the even more rarefied plasmasphere above it—have a noticeable effect on impinging electromagnetic signals. Additionally, waves of plasma known as "whistler modes" have been observed for the past 50 years or so as they bounce back-and-forth between Earth's hemispheres; thus have researchers recognized that the plasma supporting those waves is in cylindrical structures aligned with Earth's magnetic field lines. And now the inferred "plasma ducts" have been imaged in real time, in three dimensions, and over a large swath of sky. University of Sydney undergraduate Cleo Loi, her adviser Tara Murphy, and a host of colleagues used the Murchison Widefield Array (MWA) radio telescope in Western Australia to monitor cosmically distant radio sources that backlight the fluctuating plasma. As myriad sources shifted their apparent positions due to refraction by free electrons, a series of wide-angle snapshots was taken and the sources' vector displacements—as well as the divergence of those vectors—were plotted. A typical plot is shown here; the red and blue regions correspond to positive and negative divergences and also represent relative overdensities and underdensities of free electrons. The alternating structures are persistent and align perfectly with Earth's magnetic field lines, superimposed in black. In a further step, Loi and company split the MWA into halves to perceive depth just as our eyes would. The resulting 3D view confirms that the plasma structures are indeed ducts rather than sheets and that they bridge the ionosphere and plasmasphere. (S. T. Loi et al., *Geophys. Res. Lett.* **42**, 3707, 2015.) —SGB



Gauging genetic odds after repeated inbreeding. Cross pollination of two individual plants produces an offspring with two sets of chromosomes. The figure shows three genes, each having a pair of chromosome segments called alleles. One set of alleles, labeled a_1, a_2, and a_3, comes from the mother plant, and the other, labeled A_1, A_2, and A_3, comes from the father. Self pollinate the offspring (F_1) and the next generation's (F_2's) sets mix up the *a* and *A* alleles. Repeat the procedure for many generations and you end up with a recombinant inbred line (RIL), a plant with identical sets of alleles. Such plants are widely used in agriculture to locate the genes responsible for particular traits. In 1931 biologists John Haldane and Conrad Waddington worked out the probabilities for producing RILs for two and three genes. By reaching into their bag of physics tools, Areejit Samal (now at the Institute of Mathematical Sciences in India) and Olivier Martin (French National Institute for Agricultural Research) have found the long-awaited solution for any number of genes. They described allelic pairs as spins using a formula introduced by Roy Glauber for the probabilities of spin configurations in an Ising magnet, a theoretical model of ferromagnets that restricts spins to two states: up or down. Then they realized that the main unknown in their expression for the RIL probability, the expectation values of spin configurations involving four or more spins, could be solved by turning to quantum field theoretical equations developed by Freeman Dyson and Julian Schwinger. Samal and Martin say their solution may be useful for gene mapping, which relies on comparing the relative likelihood of different genotypes. (A. Samal, O. Martin, *Phys. Rev. Lett.* **114**, 238101, 2015.) —SC