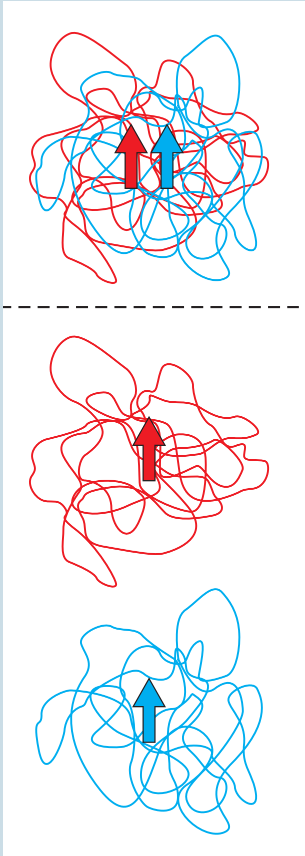
measurements show that it actually cools by a degree or two Celsius as the film evaporates, especially in the thinnest region near the center of the cornea. Mathematicians Richard Braun and Longfei Li at the University of Delaware have now resolved the discrepancy. Along with the usual physical parameters of the problem—surface tension, viscosity, lipid concentration gradients, corneal wettability, and so on—they included heat diffusion in both the tear film and the eye beneath it. Allowing for heat transport in a realistically thick substrate that includes the cornea proved to be crucial. In addition to simulating the observed cooling, the new model also reproduces the experimental thinning rate of the film, a rate that is higher for people with so-called dry eye. In the next stage, to better capture blinking dynamics, Braun and coworkers are letting one boundary of their model eye move. (L. Li, R. J. Braun, *Phys. Fluids*, in press.) —SGB

Reevaluating NMR coupling. Magnetic resonance imaging, spectroscopy, and other applications of nuclear magnetic resonance rely on the sensitivity of nuclear spins to their magnetic environment. The spins couple not only to externally applied magnetic fields but also to the dipolar fields produced by other spins. The continuous motion of atoms and molecules in liquids and gases provides a constantly varying environment that averages out the dipolar fields of neighboring spins (top) and greatly simplifies experimental and theoretical analysis. The long-range couplings don't average out so neatly (bottom), so the distant dipolar field is usually approximated as an additional applied field whose strength is proportional to the local magnetization. Though that approximation has been remarkably successful for decades, some straightforward experiments can produce results dramatically different from expectations. For example, a uniformly magnetized spherical sample has no dipole field, but tipping a trivially small fraction of the spins will produce a large effective dipolar field. Yuming Chen, Rosa Branca, and Warren Warren of Duke University have now reexamined the assumptions underlying the mean-field approximation and show both theoretically and experimentally that the mathematical framework needs to be modified for general imaging and other modern applications. At the core of those modifications is acknowledging the possibility, increasingly exploited in modern experiments, that the applied pulses don't always uniformly modulate all components of the magnetization in the same direction. The new understanding, though, can allow researchers to craft new pulse sequences that may, among other uses, enhance imaging contrast. (Y. M. Chen, R. T. Branca, W. S. Warren, *J. Chem. Phys.* **136**, 204509, 2012.) —RJF



Ancient Maya astronomical tables. As part of an urban renewal project circa 800 CE, Maya inhabiting what is now the Petén region of Guatemala filled residential dwellings with rubble and dirt before building over them. A structure's walls in the now-excavated Xultún complex have recently provided a multidisciplinary team led by archaeologist William Saturno of Boston University with an intellectual treasure: two tables, apparently of ancient astronomical reckonings. One table of hieroglyphs includes dozens of columns each with three digits. Most columns are illegible, but the final three—all of which have Moon glyphs above the digits—evidently represent a sequence of numbers separated by 177 or 178, corresponding to the number of days in the Maya "semester" of six lunar months. The second table has four columns; each of those presents a glyph above five digits that express a base-20 number. Digital enhancement of the section of wall shown in the figure revealed the hieroglyphs. The large numbers in each column are related to important Maya time periods, including the 365-day year. But each number is also an integer or half-integer multiple of the synodic periods (apparent orbital periods as perceived from Earth) of Venus and Mars. Codices dating from 1300 to 1521 CE, write Saturno and colleagues, show that the Maya sought harmony between astronomical events and sacred rituals. The Xultún tables, they continue, may have been inspired centuries earlier by the same desire. (W. A. Saturno et al., *Science* **336**, 714, 2012.) —SKB