

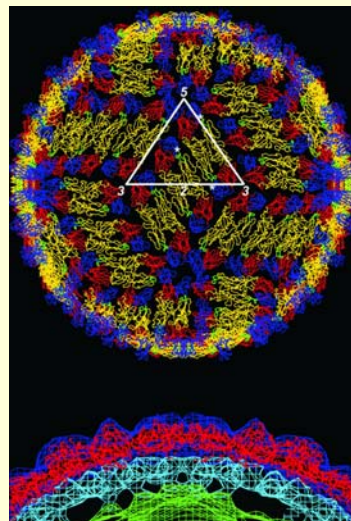
PHYSICS UPDATE

► **LIGHT-ACTIVATED PLASTIC MAGNET.** Photo-induced magnetism is of considerable interest—for example, in data storage applications. Over the past six years, the phenomenon has been seen, generated, and studied in several different materials. Now, scientists at Ohio State University and the University of Utah have produced light-induced magnetization in an organic-based material, $\text{Mn}(\text{tetracyanoethylene})_x \cdot y(\text{CH}_2\text{Cl}_2)$ ($x \approx 2$; $y \sim 0.8$). When the material was exposed to blue light from an argon laser, its magnetization increased by as much as 50%. The material was magnetic at temperatures below 75 K and retained its magnetism for days, perhaps through the formation of a metastable state in a distorted lattice. The magnetism could be partially undone by green light, and completely undone by heat. The researchers believe that the light can be selectively targeted to domains as small as, or smaller than, the wavelength of the light itself, thus possibly enabling information storage. Magneto-optic effects are currently used only to retrieve information. The new process promises to offer both reading and writing capabilities. The benefits of plastic electronic components made of plastic include flexibility, low cost, and tunability. (D. A. Pejaković et al., *Phys. Rev. Lett.* **88**, 057202, 2002.) —PFS

► **NONLINEAR LASER WITH ULTRALOW THRESHOLD.** Physicists at Caltech coupled a 70-micron silica sphere to an optical fiber, which enabled light to race around near the surface of the sphere in a “whispering gallery” mode. Whispering modes have been produced before, for example, in microdroplets, but practical applications seemed remote. The light buildup in these modes is characterized by a parameter Q , referred to as the quality factor; for the microsphere, Q exceeded 10^8 . The light can build up to such an extent that nonlinear interactions take place and engender coherent light emission. The result is a Raman laser, which is tunable and can be used as a pump for other lasers. Typically, Raman lasers need a highpower input to work at all. But the Caltech result achieved lasing with only tens of microwatts of input power—1000 times less than other Raman lasers and in a much smaller package—although the output was only picowatts. The nonlinear properties of light in the silica microspheres offer new avenues of exploring quantum optics. (S. M. Spillane et al., *Nature* **415**, 621, 2002.) —PFS

► **DENGUE VIRUS STRUCTURE SOLVED** in two steps. In its nastiest form, mosquito-borne Dengue fever leads to hemorrhaging, coma, and death. Purdue University’s Richard Kuhn and his colleagues from Purdue and Caltech first used cryoelectron microscopy to derive the virus’s rough,

24-Å-resolution shape (for more on cryoEM, see PHYSICS TODAY, March 1999, page 21). To get higher resolution, they assumed that the Dengue virus shares the same molecular building blocks as its relative, tick-borne encephalitis virus. The struc-



ture of these building blocks—glycoprotein dimers—had already been solved to atomic resolution, so the problem became how to arrange the glycoproteins to reproduce the cryoEM-derived Dengue structure. By using sophisticated image analysis, Kuhn and company verified the shared building block assumption and solved the structure of Dengue virus to a resolution of about 3 Å (see figure). Armed with the structure, they also came up with a set of molecular reconstructions that the virus executes when it infects its victim. Both the structure and the proposed mechanism could help create a vaccine for Dengue fever, which afflicts tens of millions of people worldwide every year. (R. J. Kuhn et al., *Cell* **108**, 717, 2002.) —CD

► **REGION OF VIGOROUS OCEAN MIXING LOCATED.** The world’s oceans act like large-scale conveyor belts. In the Atlantic, for example, warm water makes its way from equatorial regions to the poles, where, cooled by the frigid surroundings and salted by the formation of sea ice, it loses its buoyancy and sinks to the ocean floor. The cold “bottom water” then heads toward the equator. To keep the conveyor moving, the bottom water must be brought back to the surface or, equivalently, be mixed with warmer, shallower water. But how? Winds can drive upwelling, as can the sloshing back and forth of bottom water over rough topography. But winds can’t do the job by themselves, and significant mixing has been detected so far in only a few, relatively small regions. Now, a team from the University of East Anglia in the UK has discovered an extensive region of vigorous mixing in the Scotia Sea, an area of rough topography that lies between the Antarctic peninsula and Tierra del Fuego. Their findings, based on in situ measurements of salinity, temperature, density, and current, suggest that the Scotia Sea could play a significant role in balancing global ocean circulation. (K. J. Heywood, A. C. Naveira Garabato, D. P. Stevens, *Nature* **415**, 1011, 2002.) —CD ■