much easier in nanowires because you don't have the same strain due to lattice mismatch that arises on a 2D surface. For example, one might mate InAs with nuclear-spin-free silicon so that qubits can still be manipulated using the strong spin–orbit coupling of InAs while being stored in silicon, where they survive far longer. Another possibility is to create an optoelectronic device to convert the spin state to a photon for long-distance transportation of quantum information.

Experimenters might also be able to tailor the composition of the nanowire as a function of its length: By causing each qubit to experience a slightly different Zeeman splitting (via a difference in gyromagnetic ratios between adjacent dots), they could address each one more precisely.

Sankar Das Sarma of the University of Maryland is especially excited about InAs nanowires as a possible new approach to topological computation (see the box). The basic element of a topological computer is a non-abelian quasiparticle that does not obey the same symmetry rules as fermions or bosons under exchange of identical particles (see the article by Das Sarma, Michael Freedman, and Chetan Nayak in PHYSICS TODAY, July 2006, page 32). Das Sarma is among those who have proposed that a non-abelian particle known as a Majorana fermion might arise from spin–orbit coupling in a semiconductor, if that semiconductor is placed in a magnetic field in the proximity of a conventional superconductor.

It's certainly too early to pick a winner in the competition for the elements of a quantum computer. Perhaps a combination of approaches will be the best answer to the challenges of quantum computation.

Barbara Goss Levi

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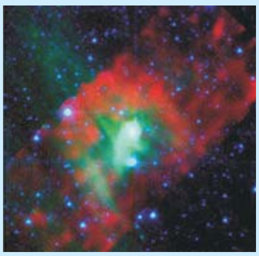
physics update

These items, with supplementary material, first appeared at http://www.physicstoday.org.

A standard candle slowly burns down. Cepheid stars are remarkable beacons. Each pulses with a regular frequency related to its intrinsic brightness. An astronomer can therefore determine the distance to a Cepheid by comparing its observed and intrinsic luminosities. Cepheids, in turn, calibrate other classes of luminosity-signaling standard candles that can be viewed from farther away. Iterating the process yields a cosmic distance ladder that enables distance estimation across the cosmos. Astronomers had long thought the behavior of Cepheids was unchanging, but Pauline Barmby of the University of Western Ontario and colleagues now report that of 29 Cepheids that the team studied, about one-fourth are losing mass. As they do so, they shroud themselves with dust that could introduce errors in distance estimations. The figure, from an earlier, related study, shows an IR image obtained with the *Spitzer Space Telescope* of one such star, Delta Cephei. The red region is a shock created as the star plows through interstellar gas and dust. The detailed form of the shock reveals that it was shaped by a stellar wind emanating from Delta Cephei that's a million times stronger than that from our Sun. So, is a lower rung on the cosmic distance ladder rotten, making the ladder itself unreliable? To the contrary, argued team member Massimo Marengo in January at the American Astronomical Society meeting in Seattle. Even with its uncertainties, the Cepheid rung is strong and observations based on the Cepheids remain trustworthy. Furthermore, now that astronomers are gaining a deeper understanding of those stars, they will be able to better determine their brightness and construct an even sturdier ladder. (M. Marengo et al., *Astrophys. J.* **725**, 2392, 2010; P. Barmby et al., *Astron. J.* **141**, 42, 2011.) —SKB



Tabletop measurements of Hawking radiation. Stephen Hawking proposed in 1974 that black holes evaporate. In essence, vacuum fluctuations near a black hole's horizon produce particle–antiparticle pairs. One of each pair falls into the hole while the other escapes. Since the escaping particle has energy, the black hole must lose energy. A blackbody temperature inversely proportional to the black hole's mass can be assigned to the process, yet the temperature is so low—on the order of 100 nK for a solar mass—that the radiation is difficult to observe directly. But William Unruh (University of British Columbia) demonstrated an analogy between the behaviors of waves near the black hole and sound waves in moving fluids. Now, physicists Silke Weinfurtner, Matthew Penrice, and Unruh and engineers Edmund Tedford and Gregory Lawrence at UBC have used another analogous system, surface waves, to study the Hawking process. They put a streamlined object shaped like an airplane wing into a channel of flowing water to create a region of high-velocity flow. Long-wavelength surface waves created downstream could propagate upstream toward that region but were blocked by the obstacle and converted into short-wavelength waves. The figure shows the converted waves (bottom) and the interference between them and the incoming wave (top). The obstacle behaves like a so-called white hole, which, as a time-reversed black hole, lets no radiation in but does let radiation escape. The conversion is the analogue of stimulated emission, and the team's measurements of the amplitudes of the converted waves matched the expected thermal distribution. Moreover, despite the system's nonlinearities, turbulence, and viscosity, and along with prior numerical work by various groups, the new results demonstrate the generic nature of Hawking radiation. (S. Weinfurtner et al., *Phys. Rev. Lett.* **106**, 021302, 2011.) —RJF ■