lateral spin, the output, to verify the computational outcome. In this way, logical one-qubit gates were realized with an average fidelity of 92 ± 4%.

Lavoie *et al.* thus demonstrate, for the first time, measurement-based quantum computation with an AKLT state. To conclude, two comments seem in order. First, one-dimensional AKLT states are not universal resources for measurement-based quantum computation. Correspondingly, the authors report in their experiment only the realization of a subset of the universal gates, namely one-qubit rotations. These gates must, in future experiments, be supplemented by a means to entangle logical qubits. Second, as already noted, the present experiment demonstrates the viability of measurement-based quantum computation using AKLT states, but not the creation of such states by cooling. The current approach represents a clever starting point as it transfers the problem from its native domain of condensed-matter physics to linear optics, a much more easily controllable scenario. The proof-of-principle AKLT measurement-based quantum computer has arrived; now watch out for the prototype! ❐

Robert Raussendorf is in the Department of Physics and Astronomy, University of British Columbia, 6224 Agricultural Road, Hennings 338, Vancouver, BC, V6T 1Z1, Canada.
e-mail: raussen@phas.ubc.ca

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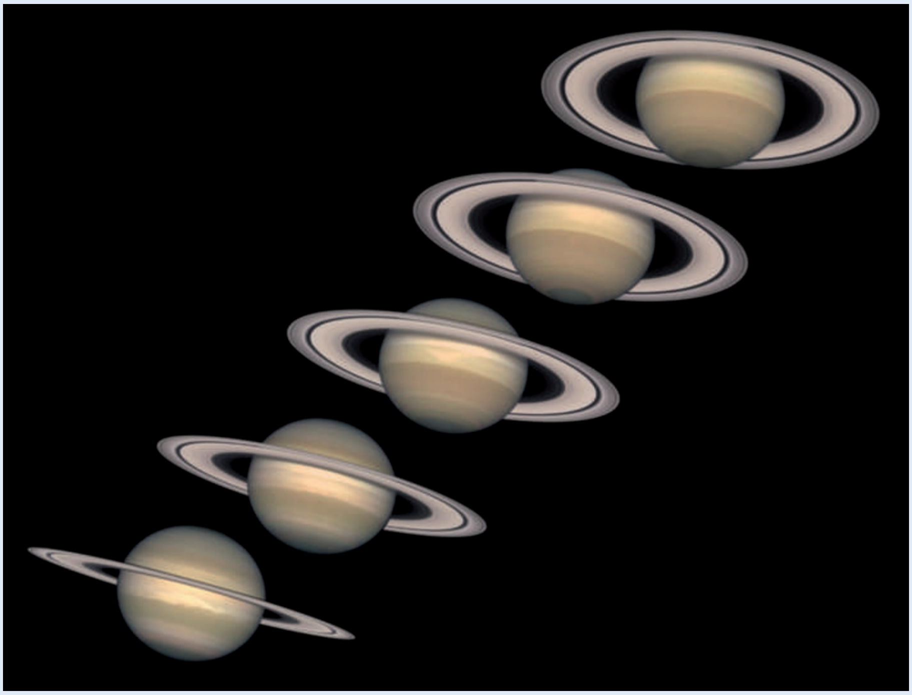
PLANETARY PHYSICS

Under the spell of the rings

“Has Saturn swallowed his children?” wondered Galileo Galilei. He was alluding to the Roman god Saturn who devoured his newborn children, fearing they would overthrow him. The year was 1612 and Galileo was confused. Two years earlier, when he had viewed Saturn for the first time through his astronomical telescopes, he saw prominent ‘ears’ on both sides of the planet. These features were gone in his 1612 observations, but then, even more confusingly, they were there again in 1613.

Galileo, unknowingly, had seen the first evidence of Saturn’s extensive ring system, and of a crossing of the ring plane — the opening of the rings is seen in these images taken by the Hubble Space Telescope between 1996 and 2000. The position of Saturn’s rings relative to the Sun and Earth influences the perceived brightness and colour of the Saturn system, and, in the journal *Icarus*, Richard Schmude presents a comprehensive model that describes how Saturn’s appearance changes as the planet orbits the Sun (*Icarus* doi:10.1016/j.icarus.2010.09.018; 2010).



NASA/STSI

Saturn’s rings are essentially two-dimensional structures — they are thought to be only a few tens of metres in thickness — and mainly composed of water ice. Relative to the planet itself, the rings are responsible for the larger part of the visible light reflected by the system, and hence determine the appearance of Saturn when viewed from Earth. But the angle between the Sun, Saturn and a terrestrial observer, called the phase angle, changes as Saturn revolves around the Sun — one round trip takes almost 29.5 years — as do the ring-opening angle and the Saturn–Sun and Saturn–Earth distances.

Schmude’s model takes these quantities into account, and integrates brightness measurements made at different wavelengths between 1963 and 1965, as well as more recent data compiled between 1991 and 2009. He finds that the brightness of the Saturn system increases as the solar phase angle decreases; at phase angles of less than two degrees, there is a further nonlinear increase in brightness, an effect known as opposition surge. Also, the colour of the Saturn system changes moderately within one orbital period. Schmude expects his photometric model should be helpful not only in future studies of the Saturn system but also of exoplanets that have bright rings.

ANDREAS TRABESINGER