note generated by the device does not guarantee the delivery of the photon, but only increases its probability by up to a factor of five (from about 0.04 to 0.2)[1]. A fundamental limitation on this probability is imposed by the quantum efficiency of the ancillary single-photon sources used in the circuit[8]. Further detrimental effects on the fidelity of the protocol arise from potential multiphoton components contained in the initial state and the ancillary photons. Theoretical research is underway to mitigate these effects, and some promising ideas have already been announced[9,10]. ❐

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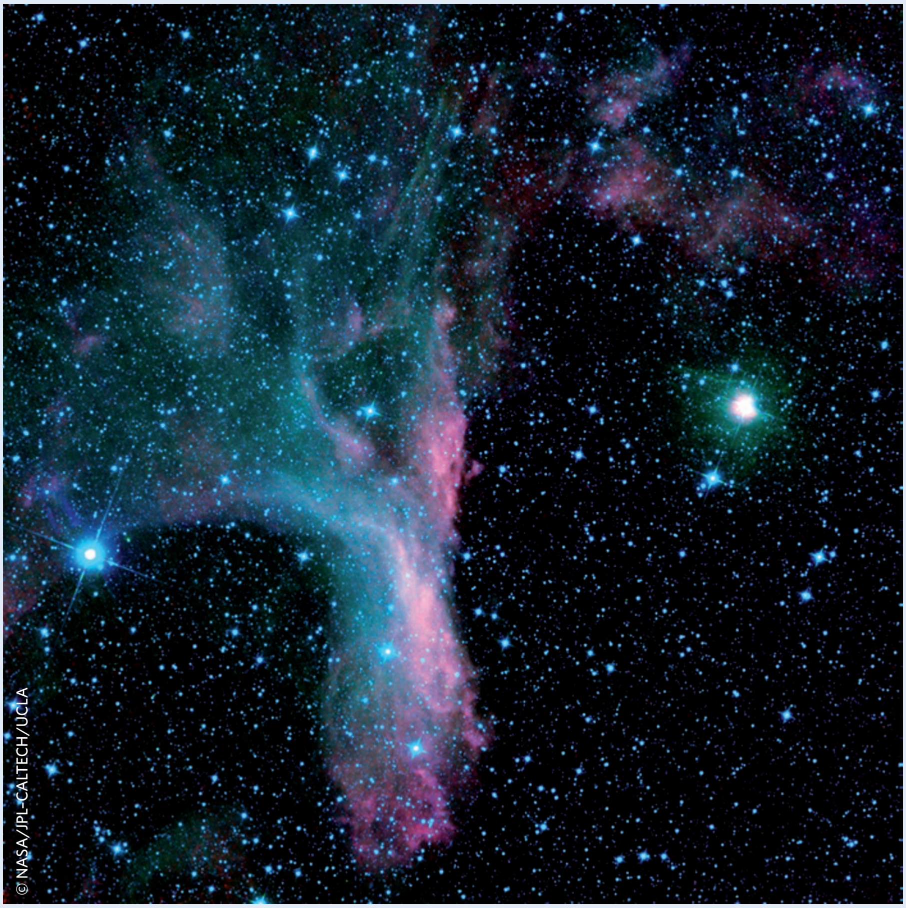
ASTRONOMY

Three for two

Wide binary-star systems — in which the stars are separated by at least 1,000 times the Earth–Sun distance — are challenging both to identify and to understand. Many binaries also have a third companion. For example, the reflection nebula DG 129 in Scorpius, pictured here, contains Pi Scorpii (on the right, appearing as one star at this resolution) — a young triple system with close binaries and a distant companion. Polaris is also a triple-star system.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Bo Reipurth and Seppo Mikkola propose that wide binaries in fact originate from triple-star systems (*Nature* **492,** 221–224; 2012).

Given that some wide binaries lie as much as 100,000 Earth–Sun distance units apart, how do we know when two stars are binaries as opposed to 'optical doubles' that are totally unrelated but for their chance positions along the optical axis of the observer? Surveys of binary stars use one of two methods: either statistical analysis of the number excess of neighbours around a candidate star as compared with a random distribution; or measurement of the common proper motion of two well separated stars (the proper motion of a star is its true motion relative to other stars, such as the Sun). A study of excess neighbours concluded that 8.3% of the main sequence stars around the Northern Galactic Pole are wide binaries (M. Longhitano and B. Binggeli *Astron. Astrophys.* **509,** A46; 2010), which is consistent with a prior estimate of 9.5% using proper motion analysis (S. Lépine and B. Bongiorno *Astron. J.* **133,** 889; 2007).

Why are wide binaries so common? There's evidence that the stars form as small multistar systems. Focusing specifically on the evolution of newborn triple systems in a gravitational potential, Reipurth and Mikkola run *N*-body simulations — 180,218 of them to be exact — and find that 7.6% of them form stable hierarchical systems, consistent with the surveys above. There are also systems that are unstable yet bound, and disrupted systems with hyberbolic outer orbits. Stable systems tend to have a dominant single star and are well separated; dominant binaries would more easily perturb a light third star and lead to disruption.

Over a timescale of 100 million years, the authors show, most of the unstable systems break up. Although the number of stable triple systems stays roughly constant, they slowly 'unfold'. The systems are thus protected from disruption by passing stars during their 'infancy' as it takes tens and hundreds of millions of years for them to reach extreme length scales. The ejection of the single star to a wider orbit brings the binaries closer together, so that the triple system appears as a wide binary from afar.

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