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THE DARK UNIVERSE

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All the matter that has ever been detected accounts for a mere 4.9% of the Universe. Most of the cosmos is the dark universe: a mix of dark matter (26.8%) and dark energy (68.3%), both of which have so far proved impenetrable puzzles.

The existence of dark matter has been inferred from the motion of stars since the 1930s, but its nature remains a mystery. The dark-matter particle posited by the most popular theory has not been shown to exist — if it is to make an appearance, it may be now or never. The search is narrowing and the possibilities are dwindling; physicists may soon have to move on to alternative explanations (see page S194).

Explaining dark energy is even tougher. The discovery of the accelerating expansion of the Universe in 1998 called for a driving force that opposes the pull of gravity (S205). At the heart of attempts to characterize this energy is a deceptively simple question: is dark energy constant? Finding out will require looking back in time, to the birth of the Universe (S201).

The ability to detect neutrinos and gravitational waves should provide new ways of observing and exploring the hitherto unseen Universe (S198). Indeed, the feeling among both Nobel prizewinners and young scientists at the 66th Lindau Nobel Laureate Meeting in June was that physicists are on the cusp of a new era in astronomy (S200).

There is much more left to learn about the dark universe (S206). It falls to the next generation of physicists, some of whom give their predictions for future research in this *Outlook*, to build on the ideas of their Nobel-winning peers. But it is clear that the dark universe will not give up its secrets lightly.

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Richard Hodson
Supplements editor

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