

INTRODUCTION

Inescapable Pull

BLACK HOLES, ONCE THE PRESERVE OF THEORY AND SCIENCE FICTION, ARE WELL-established inhabitants of the universe. Observations of the motions of stars orbiting the center of the Milky Way have proved beyond doubt that a black hole 4 million times as massive as the Sun resides there. Many other galaxies are thought to host similarly heavy or even heavier black holes at their centers. Scattered out beyond the center, there are thought to be millions of lighter, stellar-mass black holes, produced when the most massive stars collapse in on themselves at the end of their lives. This week, *Science* explores the current state of understanding of black holes with a series of Perspectives and Reviews.

Thorne (p. 536) describes what happens when black holes collide: Disturbances in the curvature of space-time produced in these collisions are the target of a number of international gravitational wave observatories. In another Perspective, Witten (p. 538) explains how black holes can be understood in terms of quantum mechanics and how this understanding, developed over the past four decades, has been applied to more down-to-earth problems such as high-temperature superconductors and heavy-ion collisions.

Fender and Belloni (p. 540) review the phenomenology of stellar black holes accreting mass from binary star companions. These systems are luminous in the x-ray regime, and many of them undergo transient bright outbursts during which the mass accretion rate onto the black hole can change dramatically over a period of days. The detailed study of these outbursts has led to progress in the understanding of black hole accretion.

Volonteri (p. 544) reviews the formation of the massive black holes that reside in the centers of galaxies and how they affect, and are affected by, galaxy evolution. This area of study has grown in importance over the last decade because of the strong observed correlation between black-hole and galaxy properties and the systematic detection of very distant active galaxies powered by massive black holes.

Finally, in the Reports section, Webb *et al.* (p. 554) present radio observations of a hyperluminous x-ray source in an external galaxy, which are consistent with the presence of a black hole with a mass between that of stellar-mass black holes and massive black holes. Intermediate-mass black holes are still mysterious, and their existence, contrary to that of their light and massive cousins, is still a matter of much debate.

— MARIA CRUZ

Black Holes

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See also Report p. 554; Science Express Report by R. C. Reis *et al.*; Science Podcast; and video at http://scim.ag/black_holes

Science

Inescapable Pull

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