Black Holes and Collapsed Stars: Our Galaxy and Its Neighbors

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On a dark New Mexico night, we see a sky that is not much changed from a year ago or a century ago. The planets move around the constellations, comets come and go, but the distant stars are steady, excepting a few pulsing or eclipsing stars and the occasional nova. When astronomers use satellites to study x-rays from the stars and galaxies, they see a much more variable and violent picture, because x-rays let us see directly into the most extreme places in our Universe: the black holes and neutron stars that mark the death of stars. The discovery of these objects in the 1960's and 70's was honored by the 2002 Nobel Prize in Physics, awarded to Riccardo Giacconi. Thanks to two new x-ray observatories in space, NASA's Chandra and the European Newton, we can study black holes and neutron stars not just in our own Galaxy, but also in its neighbors. Our own work has concentrated on the Milky Way's nearest full-sized neighbor, M31 in Andromeda. This galaxy, visible in the autumn sky, is the most distant object that we can see with the unaided eye. With the new observatories, we have studied hundreds of x-ray stars in M31, and understand the population of our neighbor, in some ways, better than our own.