Production of Intermediate-Mass Black Holes in Globular Clusters

M. Coleman Miller and Douglas P. Hamilton (*University of Maryland*),

[Contributed talk, 15min.]

Abstract

The discovery of numerous non-nuclear X-ray point sources with luminosities $L > 10^{39}$ erg s^{-1} in several starburst galaxies has stimulated speculation about their nature and origin. The strong variability seen in several sources points to massive black holes as the central engines. If the flux is isotropic, the luminosities range up to $\approx 10^{41}$ erg s^{-1}, implying masses of $M \gtrsim 10^3\,M_\odot$ if the luminosity is sub-Eddington. Here we explore a model for these sources. We suggest that in some tens of percent of globular clusters a very massive black hole, $M \gtrsim 50\,M_\odot$, is formed. This black hole sinks in $\lesssim 10^6$ yr to the center of the cluster, where in the $\sim 10^{10}$ yr lifetime of the cluster it accretes $\sim 10^3\,M_\odot$, primarily in the form of lighter black holes. Unlike less massive black holes in binaries, which are flung from clusters by recoil before they can merge gravitationally, a $\gtrsim 50\,M_\odot$ black hole has enough inertia that it remains bound to the cluster. We suggest that $\sim 10^3\,M_\odot$ black holes may be common in the centers of dense globular clusters, and may therefore exist in some tens of percent of current globulars. If the cluster later merges with its host galaxy, accretion from young star clusters in molecular clouds by the black hole can generate luminosity consistent with that observed. We also consider the detectability of massive black holes in globular clusters with gravitational wave detectors such as LISA and LIGO, and speculate on future observations that may test our predictions.

CATEGORY: BLACK HOLE AND NEUTRON STAR BINARIES