and fainter slowly during the later phase. (3) A synthetic galaxy appears the maximum brightness at ~ 1Gyr which is about 2,500 times of the present brightness(t=15Gyr). (4) The star formation is still continued, although the number of stars which were born during the period of recent 1Gyr is very small (~1% of total number of stars). (5) A significant effect of metallicity spread is shown in the main sequence on C-M diagram. (6) The contribution of giants to the total luminosity is about 32 ~ 58% and average metallicity is about 2.9 ~ 4.0Z⊙.

Effects of 10 M⊙ Black Holes on the Dynamical Evolution of Galactic Nuclei

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A star with main sequence mass greater than 25 ~ 30M⊙ may collapse to a black hole of about 10 M⊙ at the final stage of the evolution. About an order of 1% of stellar mass is likely to be in form of such black holes in galaxies. We have examined the dynamics of two-component stellar systems composed of 0.7 M⊙ main-sequence stars, representing the old population of stars whose main-sequence lifetimes are longer than the Hubble time, and a small fraction of 10 M⊙ black holes. The dynamical friction leads to the segregation of black holes to the core and the core collapse takes place among the black holes in a time scale much shorter than that required for a single component cluster. The ultimate evolution of the two-component stellar system depends on the role of three-body binaries formed among the black holes. For a system with $v \gtrsim$ 100km/sec binaries merge by gravitational radiation at some hardness instead of being ejected. the critical hardness, at which the collision time and the merger time become comparable, determines the efficiency of the binary as a heat source. The efficiency is found to be inversely proportional to the velocity dispersion. For the clusters without serious reduction in heating efficiency (i.e., velocity dispersion well below 500 km/sec), heating by three-body binaries have the effect of stopping the core-collapse. The cluster expands, but at a rate set by the half-mass relaxation time of the whole system which is very long. Thus one obtains nearly static two-component configuration: central cluster of black holes surrounded by low mass clusters. However, such a state would not last longer than Hubble time if $v \gtrsim$ 50km/sec because most of the black holes would experience binary formation and subsequent mergers. A seed black hole can easily form in the central parts of galaxies with even moderate initial conditions (i.e., $v_c \gtrsim$ 100km/sec).

VARIABILITY OF ACTIVE GALACTIC NUCLEI DUE TO FIELD-ACCRETING MODES

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Variability of the emission-line spectra of active galactic nuclei is now a well-known phenomenon. This remains to be fully explained by a theoretical model of the central engine