A MODEL FOR THE GLOBULAR CLUSTER LUMINOSITY FUNCTION

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We develop the idea (Harris & Pudritz 1994, ApJ, 429, 177) that, like currently forming star clusters and associations, globular clusters (mean mass $\simeq 3\times 10^5 M_\odot$) were born in the 'cores' of much larger ($\sim 10^8 - 10^9 M_\odot$) star-forming complexes which we call 'supergiant molecular clouds,' or SGMCs. The number $N(m)$ of protoclusters at mass m is then determined by a steady-state balance between their growth by core–core collisions, and their self-destruction via the side effects of star formation. This mass spectrum is ultimately passed on to the globular cluster system (GCS) itself, by virtue of the very high star-formation efficiency required to produce a bound stellar cluster from a gaseous core.

The major influence on the shape of the GCS mass spectrum is the ratio β of fiducial core disruption and collision timescales. Our models are further characterized by a *mass-dependent* core lifetime: below a critical mass m_*, star formation is too passive to disrupt a core; but above this limit, cores will self-destruct in a finite amount of time. We identify m_* with the peak magnitude of the globular cluster luminosity function [$\phi \sim mN(m)$]. Its value and the peak mass m_1 of the luminosity-weighted luminosity function [$\psi \sim m^2 N(m)$] are then used to fit the observed mass spectra (above m_*) of the Milky Way, M31, and M87 GCSs (see McLaughlin & Pudritz 1996, ApJ, 456, in press; also Harris, these proceedings).

Our main results are: (1) The ratio β, and hence the shape of the GCS mass spectrum, is expected to be independent of position within a galaxy. (2) m_1 varies among GCSs, and is roughly that mass above which a core's collisional growth time is longer than its lifetime. (3) More massive cores in a given SGMC must be shorter-lived; specifically, the data imply that core disruption times scale as $m^{-0.6}$ above m_*. (4) β is significantly larger, and the GCS mass spectrum shallower, in M87 than in the Local Group spirals. This is likely an effect more of environment than of Hubble type alone.

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