Basic Code Structure

Input   Read input parameters

Initial conditions   Generate m, $\mathbf{r}$, $\dot{\mathbf{r}}$

Initialization $\mathbf{F}$, $\dot{\mathbf{F}}$ & Δt

Scheduling   Block-step distribution

Prediction   All N particles

Force calculation   Forces and derivatives

Particle integration   Sequential $\mathbf{F}$&$\dot{\mathbf{F}}$

Corrector   Fourth order

New time-steps   Relative criterion

New block-steps   Determine next group

Results   Cluster parameters

Stellar Evolution

Stellar HR types	$K^* = 0, ..., 15$
Fast look-up (Pop I & II)	$r^*(t),\ m_c(t),\ L^*(t),\ K^*(t)$
Wind mass loss	$\dot{m} = -2 \times 10^{-13}\, r^*\, L^*/m$
Single stars	$\Delta m/m > 1\,\%, \quad \text{new} \quad r^*$
Updating times	$T_{\mathrm{ev}} = t + \min(\Delta t_{\mathrm{ev}},\, \Delta t_{\mathrm{rem}})$
Stellar rotation	$\Delta J_{\mathrm{spin}} = 2\Delta m r^2 \Omega_{\mathrm{rot}}/3$
White dwarfs	cooling curves, $\quad \Delta t_{\mathrm{ev}} = 10^6\,\mathrm{yr}$
Supernova outburst	$m_{\mathrm{c}} > m_{\mathrm{chandra}} \quad \Rightarrow \quad \mathrm{SN}$
NS velocity kick	$v >> v_\infty \sim 2\,km/s$
Binary mass loss	$m\,a = \mathrm{const}$
Synthetic HR diagram	binaries and single stars
Energy conservation	$\Delta E = \Delta m\,(\tfrac{1}{2}\,v^2 + \Phi)$

Three-Body Dynamics

Basic interactions $\qquad B + S \Rightarrow \tilde{B} + \tilde{S}$

Fast escapers $\qquad$ Resonance or radial intruder

Formation of hierarchy $\quad B + B \Rightarrow \tilde{B} + S + \tilde{S} \Rightarrow T + \tilde{S}$

Hierarchical stability $\qquad$ Constant inner period

Induced collision $\qquad$ Kozai cycles $\Rightarrow e_{\max}$

Gravitational slingshot $\qquad$ Internal/external effects

PN Scenarios

Unperturbed binaries BH or NS

Globular clusters BH or NS $+ N^*$

Galactic centres IMBH $+$ BH $+ N^*$

Supermassive systems SMBH $+$ IMBH $+ N^*$

Energy considerations $\dfrac{m_1 m_2}{2a^*} = \kappa |E_{\text{tot}}|, \quad E_{\text{tot}} = -0.25$

Super-hard binary $m_1 = 10\bar{m}, \quad \kappa = 0.1, \quad a^* = \dfrac{2000}{N^2}$

Schwarzschild radius $R_{\text{Sch}} = \dfrac{2M}{c^2}$

GR radiation time-scale $t_{\text{GR}} \propto \dfrac{c^5 a^5}{m_1^2}(1 - e^2)^{7/2}, \quad c = \dfrac{3 \times 10^5}{V^*}$