

# “Kitchen Sink” Models

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- *Disclaimer:* these notes describe only published results from star-cluster models incorporating realistic treatments of dynamics, stellar evolution, and external fields. At present, that restriction limits the scope to N-body calculations, although Monte-Carlo simulations satisfying these criteria are expected soon.
- I also explicitly omit the many earlier papers using Fokker-Planck and gas-sphere models that have contributed greatly to our understanding of cluster evolution.

# Models with Simplified Stellar Evolution

- Terlevich (1987) N-body,  $N \sim 10^3$ 
  - cluster mass loss and dissolution time scales
- Chernoff & Weinberg (1990) Fokker-Planck
  - influential parameter-space survey of cluster lifetimes
- Fukushige & Heggie (1995) N-body,  $N \sim 1-16k$
- de la Fuente Marcos (1997) N-body, 1k
- Portegies Zwart et al. (1998) N-body, 1-32k
- Takahashi & PZ (1998) N-body/FP

# Detailed N-body Models (“kitchen sink”)

- N-body factory (Aarseth, Hurley, Pols, Tout,...)
  - 1998 binaries in young LMC clusters (Elson et al.):  $10^4$ , 20%
  - 2001 gas loss from a young cluster (Kroupa et al.):  $10^4$ , 100%
  - 2001 blue stragglers in M67 (Hurley et al.): 15k (2.5 Gyr), 0-50%
  - 2002 planets, exchange interactions, “loaded guns”  
(Hurley & Shara): 20k, 10%
  - 2002 de la Fuente Marcos: up to 10k, ?%
  - 2003 white dwarf sequences (Hurley & Shara): 28k, 40%
  - 2003 core radius evolution of young LMC clusters  
(Wilkinson et al.): 5k, 0-50%
  - 2003 clusters in tidal fields (Baumgardt & Makino): 8-128k, 0%

# Detailed N-body Models (“kitchen sink”)

- Starlab (PZ, Hut, Makino, McMillan,...)
  - 1999 runaway collisions in R136: 12k, 0%
  - 2000 formation of black-hole binaries: 2-10k, 0%
  - 2001, 2002 lifetimes and visibility of young star clusters in the Galactic center: 12k, 0%
  - 2001, 2004 detailed studies of Hyades and Pleiades: 3k, 50%
  - 2002 runaway collisions in young dense clusters: 64k, 0%
  - 2002, 2003 (no) intermediate-mass black holes in M15, G1: 64k/128k, 0% (Baumgardt et al.)
  - 2003 (×2) inspiral to the Galactic center: 64k, 0%
  - 2004 collision runaways in M82: 128k-580k, 0-10%

# Other Detailed Models (in the works)

- Monte Carlo simulations
- Scattering experiments with stellar/binary evolution
- “Hybrid” models
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