

First, second and third massive stars in Open Clusters

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Problem description

Mass spectrum
(theory)

Cluster mass (generally
unknown)

Most massive star
(observations)

Kroupa mass spectrum

Spectrum

According to Kroupa (2001)

$$\alpha_0 = +0.30 \quad 0.01 \leq m/M_{\odot} < 0.08,$$

$$\alpha_1 = +1.30 \quad 0.08 \leq m/M_{\odot} < 0.50,$$

$$\alpha_2 = +2.35 \quad 0.50 \leq m/M_{\odot} < m_{\max}.$$

Ignored effects

- ▶ Stellar binarity;
- ▶ Stellar evolution;
- ▶ Cluster dynamics;

Sampling algorithms

- ▶ Random;

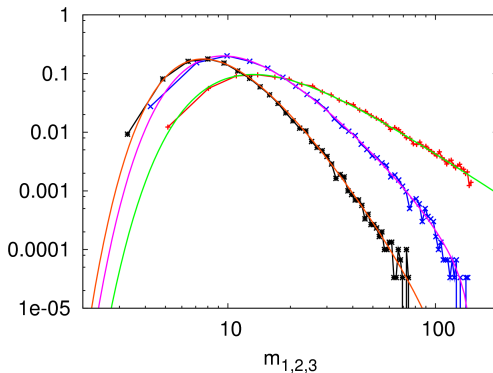
Sampling algorithms

- ▶ Random;
- ▶ Constrained;

Sampling algorithms

- ▶ Random;
- ▶ Constrained;
- ▶ Sorted;

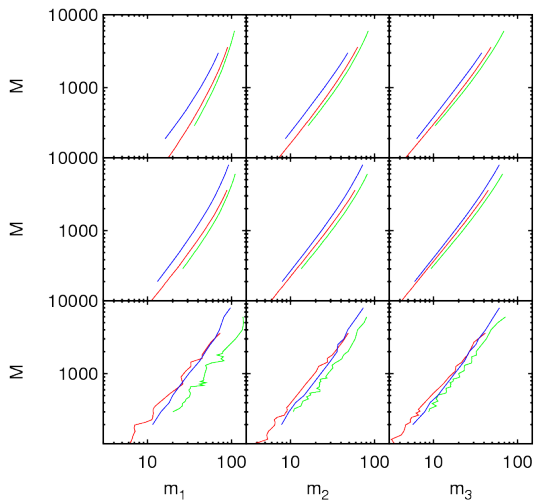
Distribution for masses of 3 most massive stars



Building the estimator function

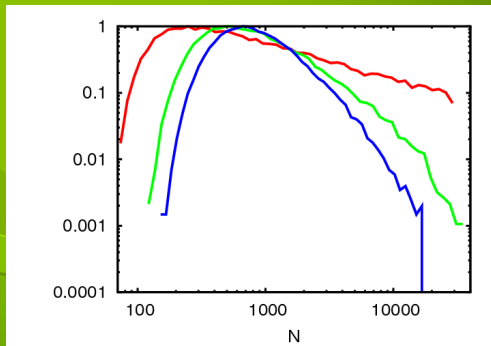
$$M_{\text{cl}}(m_{1,2,3}) = am_{1,2,3}^b (m_{\text{max}} - m_{1,2,3})^c$$

$$M_{\text{cl}}(m_i)$$



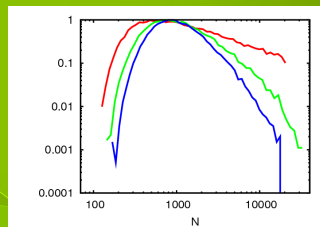
Estimator's error distribution

Estimator built on average values.
Distribution of estimated N (real value = 1000).



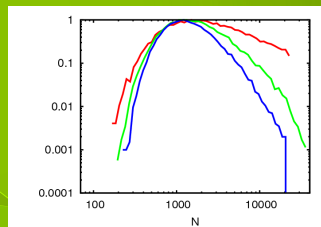
Estimator's error distribution

Estimator built on median values.
Distribution of estimated N (real value = 1000).



Estimator's error distribution

Estimator built on
mode values.
Distribution of
estimated N (real
value = 1000).



Conclusions

1. Mode or median should be used to build mass estimator;
2. Errors have power-law tail;
3. Second or third massive star is a better choice because:
 - ▶ less affected by the unknown m_{\max} ;
 - ▶ have smaller errors;