The IMF in Young Massive Star Clusters: do we understand the completeness?

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• Introduction on MF

• Artificial star experiment

• Uniform Distribution vs Spatially Varying models

• Synthetic observations (using MYOSOTIS)

• Examples of completeness-corrected MF

• Conclusion
Importance of Mass Function

Mass, age, source distribution, stellar parameters, ...

Problems:

- Evolutionary and atmosphere models limitations
- Observational/instrumental effects
- Challenges posed by target itself
Mass, age, source distribution, stellar parameters, ...

Mass Uncertainty:

- Evolutionary and atmosphere models limitations
- Observational/instrumental effects
- Challenges posed by target itself
Observed MF should be corrected for completeness:

- Artificial star experiment is applied on the observed image
- Completeness function is estimated and applied to correct MF

Where to put the artificial stars in the image?
Adding artificial stars with a given magnitude on the original image and estimating the completeness by photometry.
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Siriani+2000
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SVM:

- Sensitive to the shape of the star cluster and its structure
- Depends on the magnitude of the artificial star

RMC136, HST/WFPC2, $V_{\text{mag}} = 21.56$

What is the real completeness?!
Make Your Own Synthetic ObservationS (MYOSOTIS)

**Inputs:**
- **Stars info**: Position, velocity, mass, age of stars (e.g. From Nbody simulations)
- **Cloud info**: Cloud particle’s position, mass, smoothing lengths (e.g. from SPH codes)
- **Telescope info**: Resolution, detector, Filter, FoV
- **Observing conditions**: Atmospheric condition, Adaptive Optics, Line-of-sight, distance of the object

**Outputs:**
- 
  * _image.fits*: 2D fits image
  * _star_info.txt*: contains the information of the stellar sources in the FoV
  
  If spectroscopy='yes' the two other outputs:
  * _cube_spectra.fits*: 3D cube, X-Y is the position of stellar sources, z is flux in different wavelengths
  * _Lambda.txt*: the wavelengths [Å] which is used for the 3rd dimension of the spectral_cube

Khorrami et al. 2019

Written in IDL and PYTHON available in: [http://github.com/zkhorrami/MYOSOTIS](http://github.com/zkhorrami/MYOSOTIS)

Try MYOSOTIS on Thursday at Demonstrations
$M = 10^4 M_\odot$

$R_h = 0.5 pc$

$Age = 2 Myr$

$Distance = 50 Kpc$

HST resolution in V- & I-band

No Binaries, No extinction
Very simple case!

Synthetic images produced by MYOSOTIS (Khorrami et al. 2018)
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Synthetic images produced by MYOSOTIS (Khorrami et al. 2018)
\[ M = 8.5 \times 10^3 M_\odot \]
\[ R_h = 1.1 \text{pc} \]
\[ \text{Age} = 5 \text{Myr} \]
\[ \text{Distance} = 50 \text{Kpc} \]

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Synthetic images produced by MYOSOTIS (Khorrami et al. 2018)
• **Observations:** MF should be corrected for completeness

  Completeness function is different for different observations!

• **Simulations:** NOT to be compared directly with the observation

  Make synthetic observations first!

Spatially Varying Model: [https://github.com/zkhorrami/SpatiallyVaryingModel.git](https://github.com/zkhorrami/SpatiallyVaryingModel.git)

MYOSOTIS: [http://github.com/zkhorrami/MYOSOTIS](http://github.com/zkhorrami/MYOSOTIS)
Uniform Distribution Model
Uniform distribution or spatially varying model?

Uniform Distribution Model

Spatially Varying Model