Morphology of the Large and Small Magellanic Clouds using Fundamental Mode Cepheids

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Daniel Wysocki

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Magellanic Clouds

What are they?

- two dwarf galaxies which orbit the Milky Way

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- irregular galaxies

Large Magellanic Cloud (LMC)

- 50kpc away

Small Magellanic Cloud (SMC)

- 60kpc away

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  - can be used as a distance calibrator to more distant galaxies

Variable Stars

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- the variation can be related to physical properties of the star

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- for periodic variables, time can be transformed into phase
- shape, amplitude, and period of a star's light curve can reveal many things

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- obey a period-luminosity-color relationship

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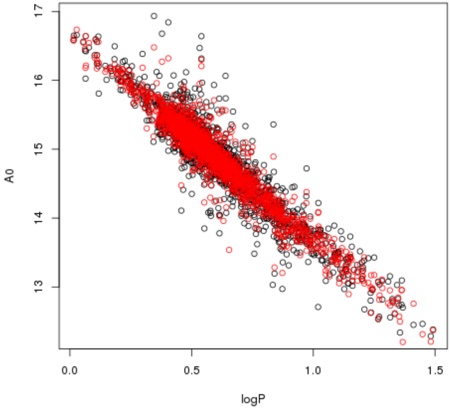
$$\overline{M}_\lambda = \alpha_\lambda \log P + \beta_\lambda + \epsilon_\lambda \tag{2}$$

Period-Luminosity-Color Relationship



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- Classical Cepheids can be used in the same way

Distance Modulus

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- for N stars, this results in a system of $2N$ equations with $N + 4$ unknowns

Galactic Morphology

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- introduce distance (D), and the coordinate system now describes three dimensional space

Cartesian Coordinate System

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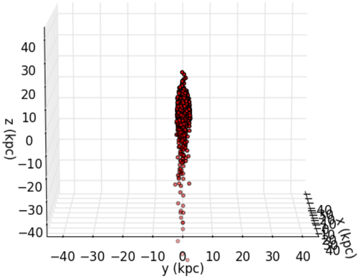
- can be obtained from equatorial coordinate system through the following transformations

$$x = -D \sin(\alpha - \alpha_0) \cos \delta,$$

$$y = D \sin \delta \cos \delta_0 - D \sin \delta_0 \cos(\alpha - \alpha_0) \cos \delta,$$

$$z = D_0 - D \sin \delta \sin \delta_0 - D \cos \delta_0 \cos \alpha - \alpha_0 \cos \delta$$

LMC in 3D



Inclination and Position Angles

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- does not do a very good job describing the 3D structure of the galaxy

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- fits a 3D ellipsoid to the collection of stars
- principal axis transformation is performed on moment of inertia tensor
- transformation gives eigenvalues and eigenvectors, which are used to describe the size and orientation of the axes of the ellipsoid

Acknowledgements

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