# *Determination of the lower bound of the Milky Way mass on basis of motion of the distant halo tracers*

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# The outline

- The motivation
- The motion of the halo tracers in the point mass approximation. The role of the phase-space modelling and a determination of the lower bound of the Milky Way mass
- The stability of the phase-space distribution function in a more realistic potential

This work has been done in collaboration with:
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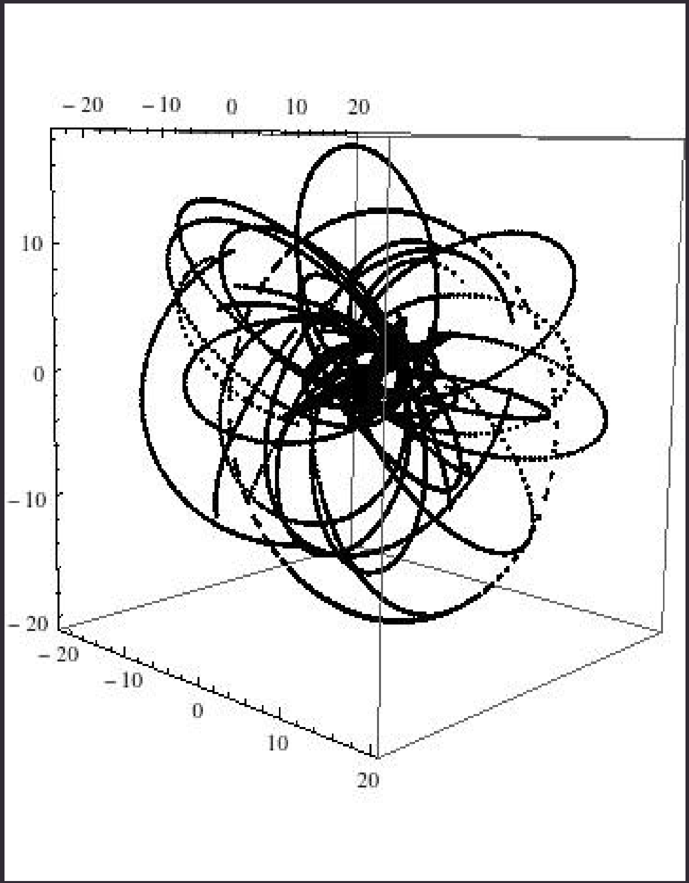
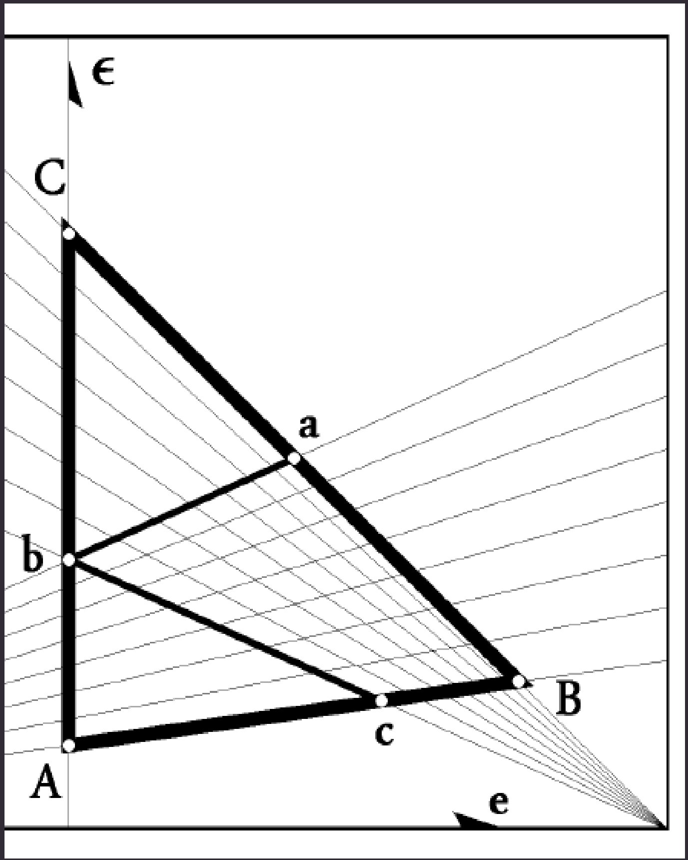
prof. Marek Kutschera (IF UJ)

# The point mass approximation




$$e = \sqrt{1 + \frac{2EJ^2}{G^2M^2}}, \quad 0 \le e < 1, \qquad \epsilon = -\frac{RE}{GM} > 0.$$

# The phase-space distribution function

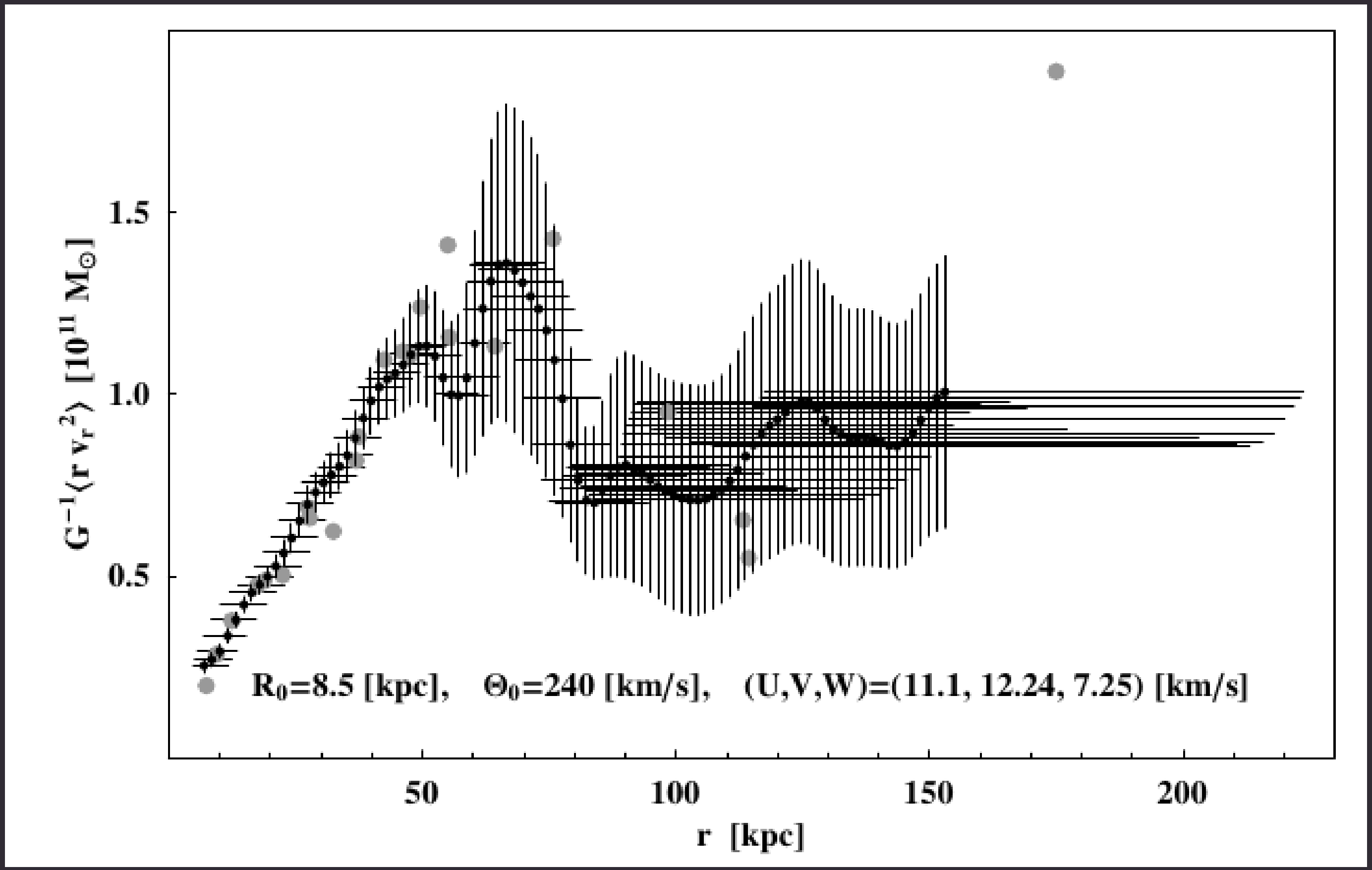
$$\int f(\vec{r},\vec{v})\mathrm{d}^3r\mathrm{d}^3p \propto \int_{u_a}^{u_b} \mathrm{d}u\,\mu_u[f]$$

$$\mu_u[f] = \int_{S(u)} \mathrm{d}e\,\mathrm{d}\epsilon\,\frac{e\,f(e,\epsilon)}{\sqrt{\epsilon\left(\epsilon-\frac{1-e}{2u}\right)\left(\frac{1+e}{2u}-\epsilon\right)}}$$

$$\langle g\rangle_r = \frac{\mu_u[fg]}{\mu_u[f]}$$

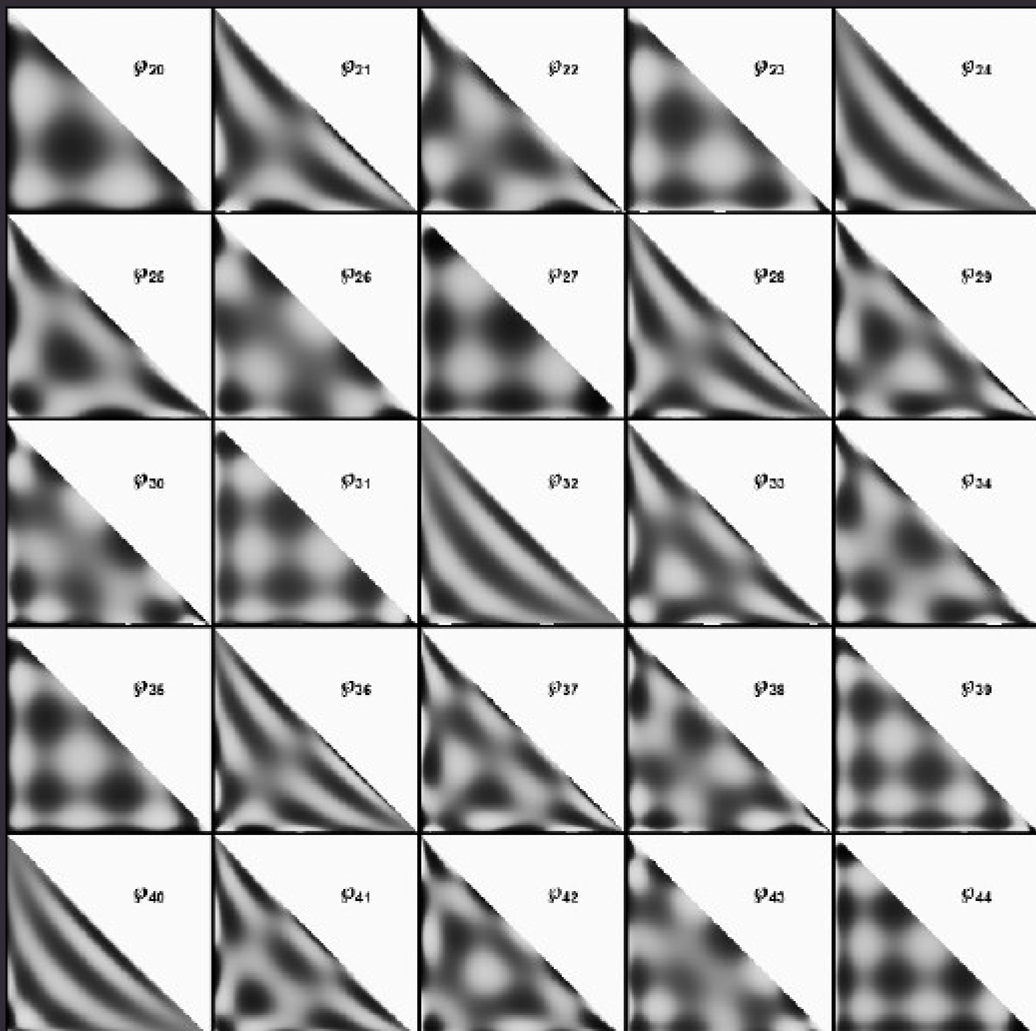
The average of the physical quantity g on the sphere of radius r

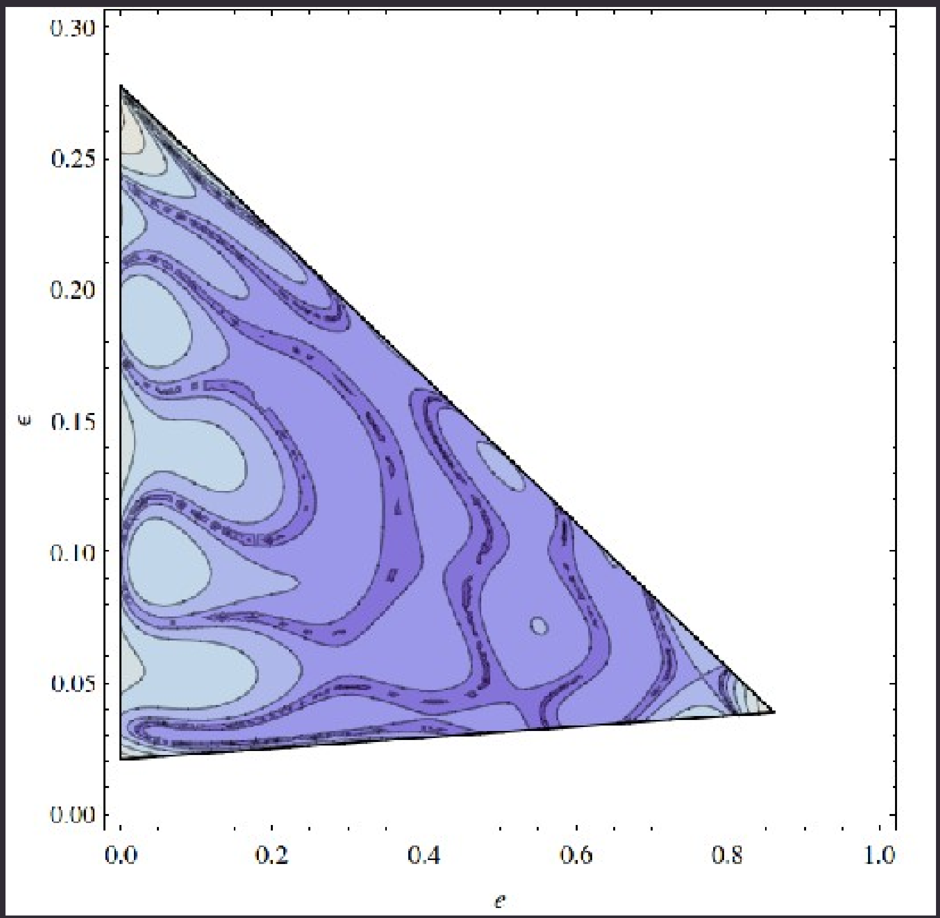
# The radial velocity dispersion profile



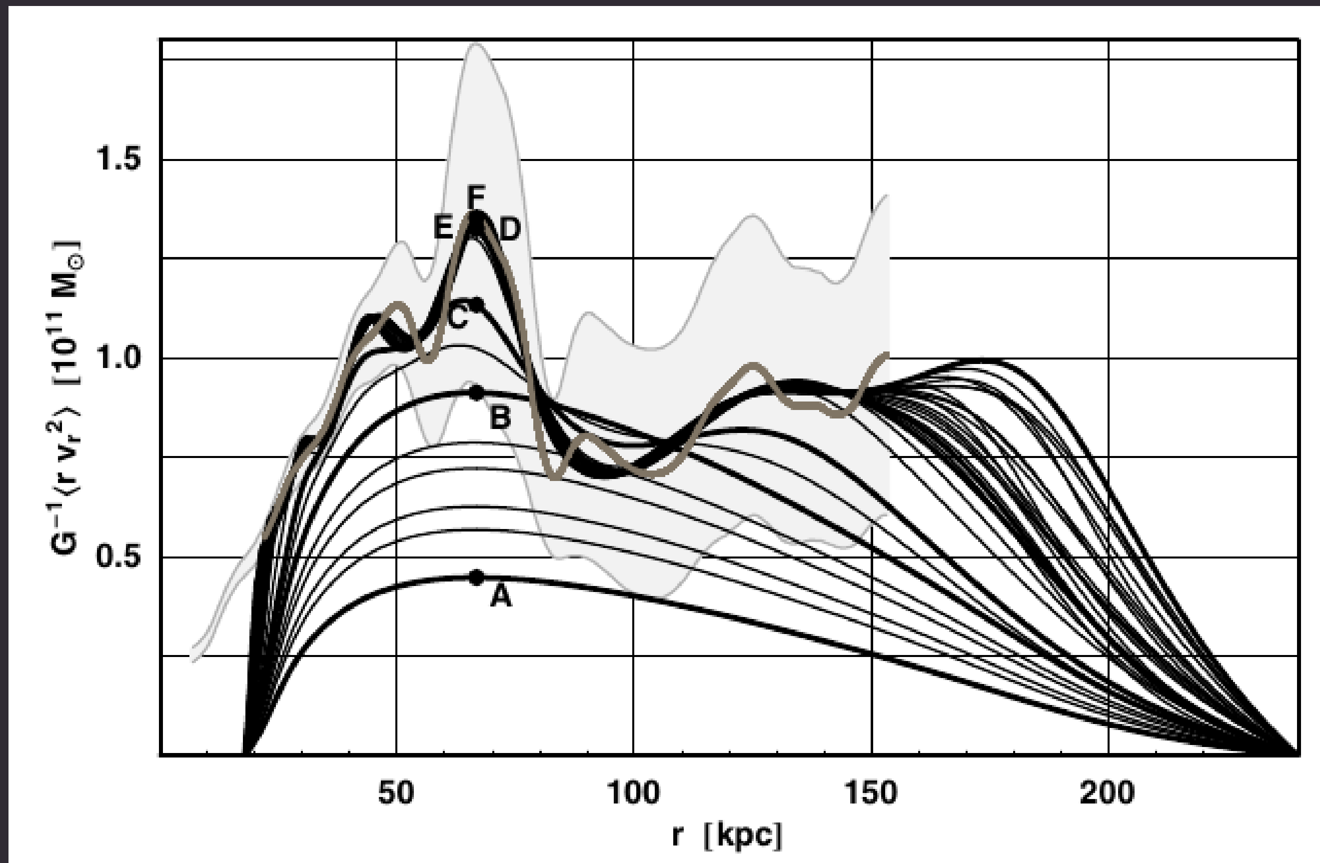

$$\frac{r v_r^2}{2\,GM} = \frac{(1-\alpha)\,(\beta-1)}{\alpha+\beta}$$

# Reconstruction of the PDF without constraints



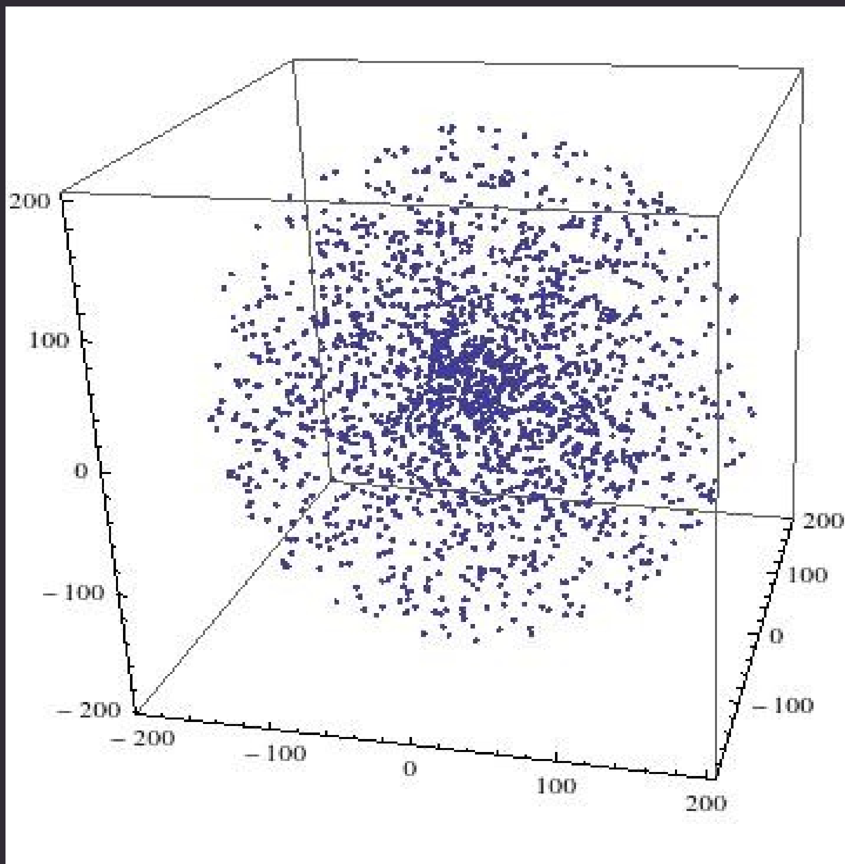



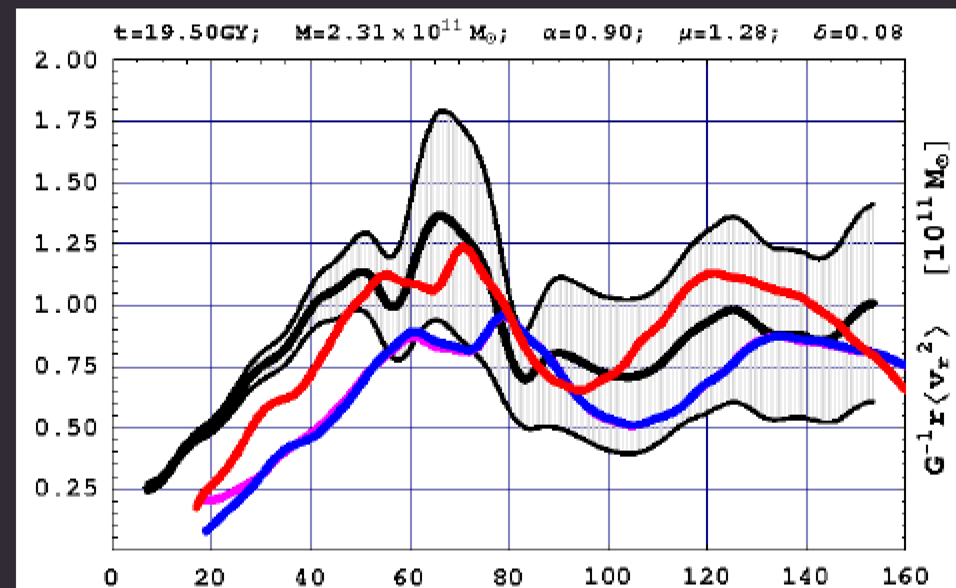
# The lower bound of the MW mass




$$M_{low} = 1.8 \times 10^{11}\, M_\odot$$

# The more realistic potential




$$(2.12 \pm 0.13) \times 10^{11} \mathrm{M}_{\odot}$$

# References


Bratek Ł., Sikora S., Jałocha J., Kutschera M., A&A, 562, A134 (2014)
„A lower bound on the Milky Way mass from general phase-space distribution function models"

Sikora. S., Bratek Ł., Jałocha J., Kutschera M., [arXiv:1410.1051]
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