Czy krzywa rotacji Drogi Mlecznej jest płaska?

Szymon Sikora
Obserwatorium Astronomiczne UJ

Grupa badawcza:
prof. Marek Kutschera
dr hab. Joanna Jałocha
dr hab. Łukasz Bratek
dr Szymon Sikora
dr Piotr Skindzier

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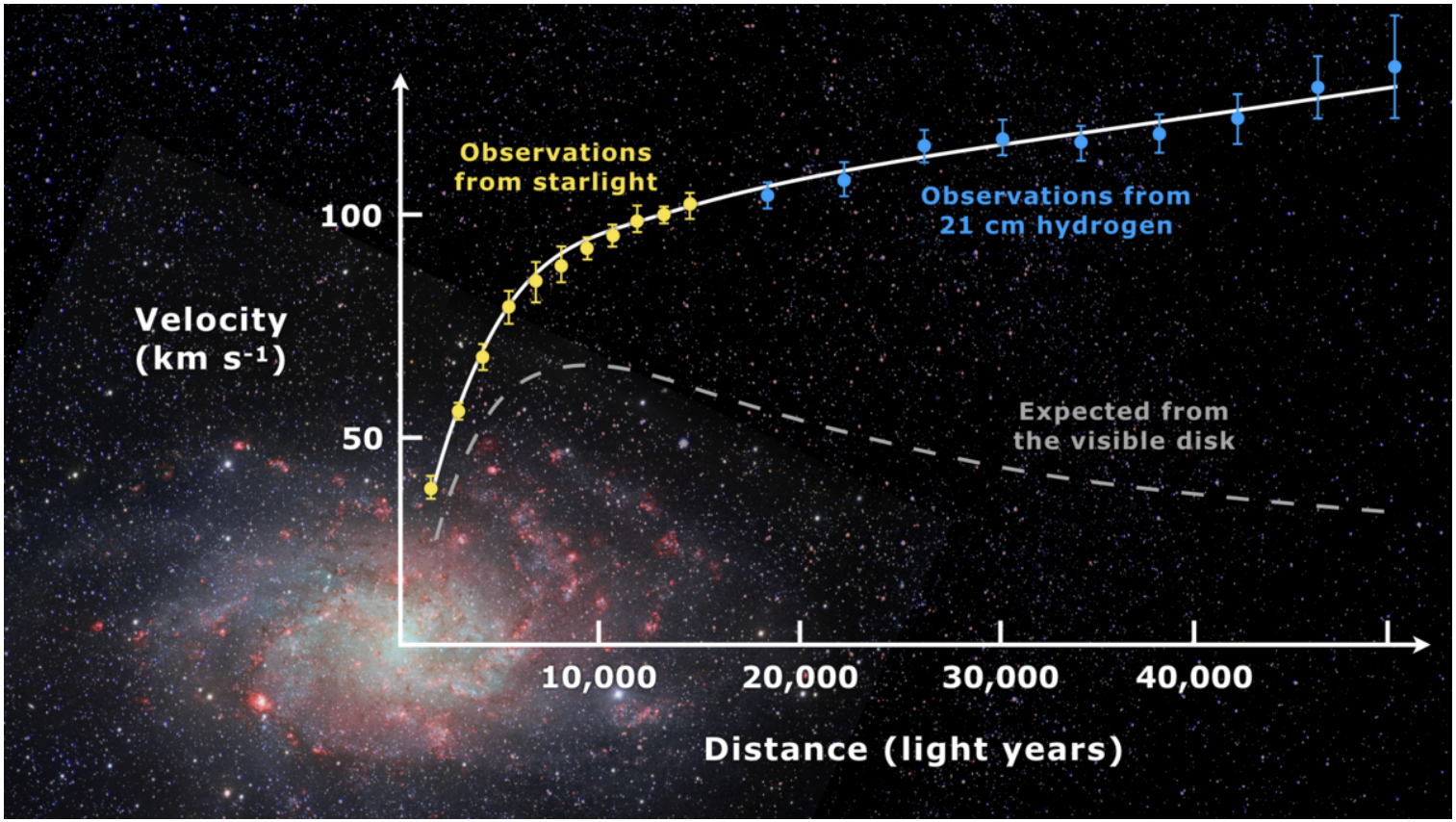
Krzywe rotacji galaktyk spiralnych



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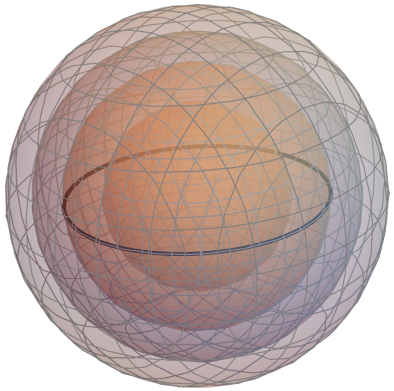
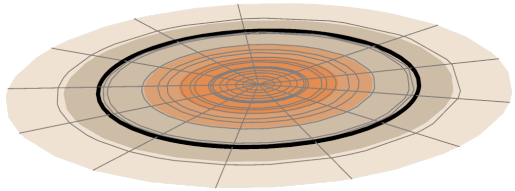
Krzywe rotacji galaktyk spiralnych



$$\frac{G\,M(r)\,m}{r^2} = \frac{m\,v^2(r)}{r}$$

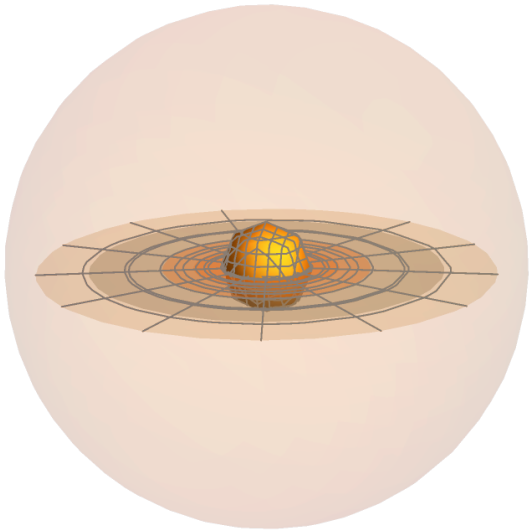
Krzywe rotacji galaktyk spiralnych



$$\sigma(r) = \frac{1}{G\pi^2}\left[\int_0^r \frac{dv^2(r')}{dr'}\frac{K(r'/r)}{r}dr' + \int_r^\infty \frac{dv^2(r')}{dr'}\frac{K(r/r')}{r'}dr'\right]$$

$$v^2(r) = 4Gr\left[\int_0^r \sigma(r')\frac{r'E(r'/r)}{r^2 - r'^2}dr' - \int_r^\infty \sigma(r')\left[\frac{r'^2E(r/r')}{r(r'^2 - r^2)} - \frac{K(r/r')}{r}\right]dr'\right]$$

Krzywe rotacji galaktyk spiralnych



Metoda parametryczna. Rozkład materii rozłożony na kilka komponentów i modelowany przy pomocy prostych funkcji.

- dysk eksponencjalny: $\sigma(r) = \sigma_0 \exp(-r/r_0)$
- model Mestela dysku: $\sigma(r) = \sigma_0 \frac{r_0}{r^2}$
- zgrubienie centralne
- sferyczne halo

Krzywe rotacji galaktyk spiralnych

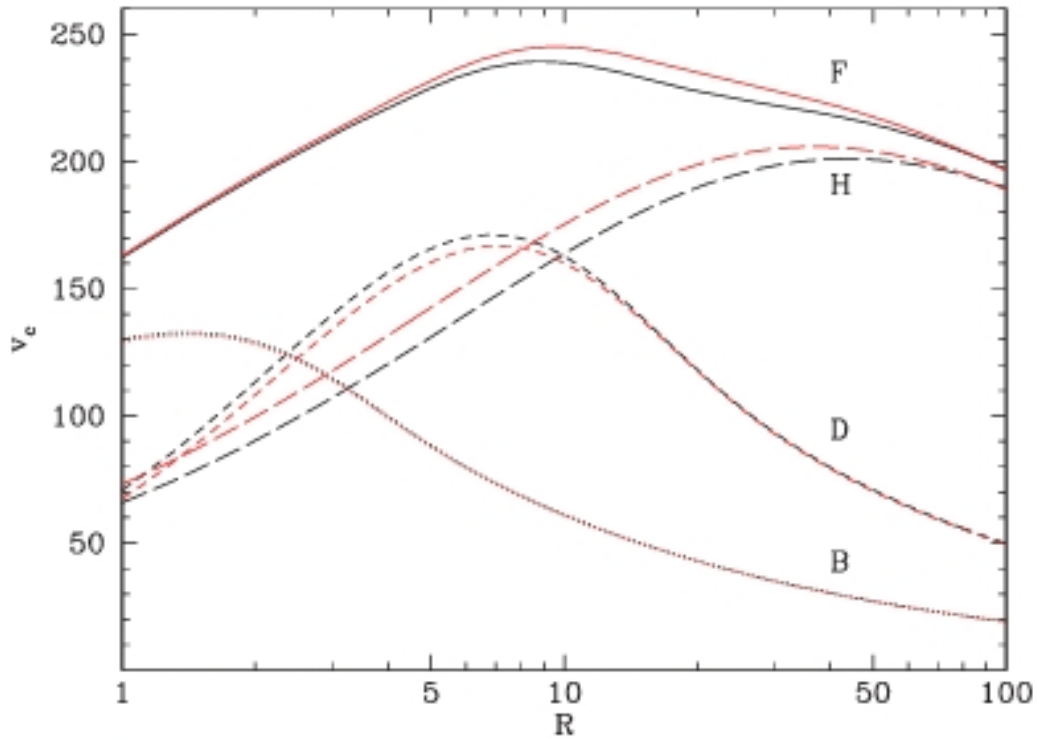
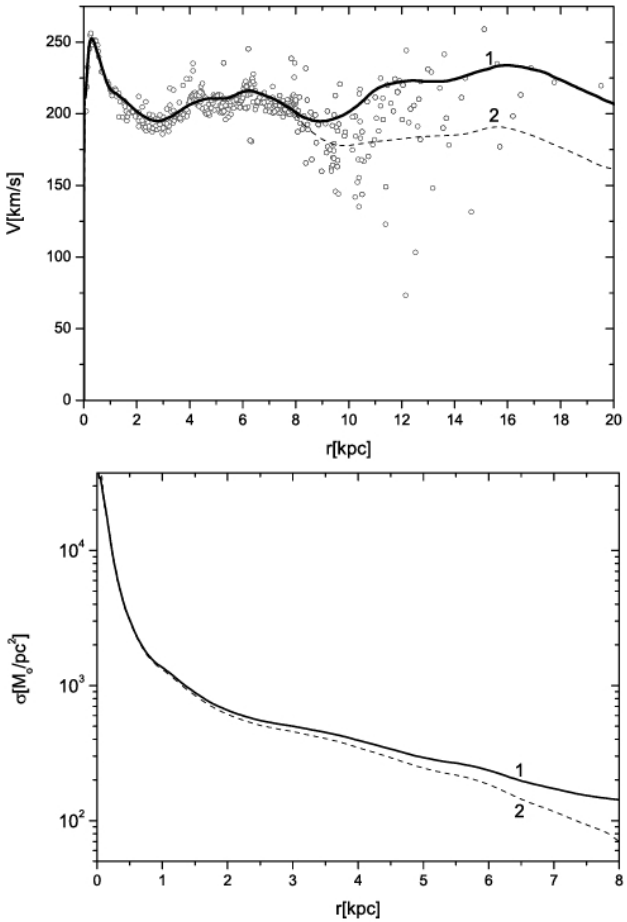


Figure 5. The rotation curve for our best-fitting (black) and convenient (red) models – note that radius is plotted logarithmically. The solid line, labelled F, is the full rotation curve, with the other curves showing, in each case, the contribution of the bulge (B, dotted), discs (D, short-dashed) and halo (H, long-dashed).

McMillan, MNRAS 414, 2446–2457 (2011) $M = 1.26 \times 10^{12}\, M_\odot$

Model dyskowy galaktyk spiralnych



$M = 2 - 3 \times 10^{11}\, M_{\odot}$

Wertykalny gradient prędkości rotacji

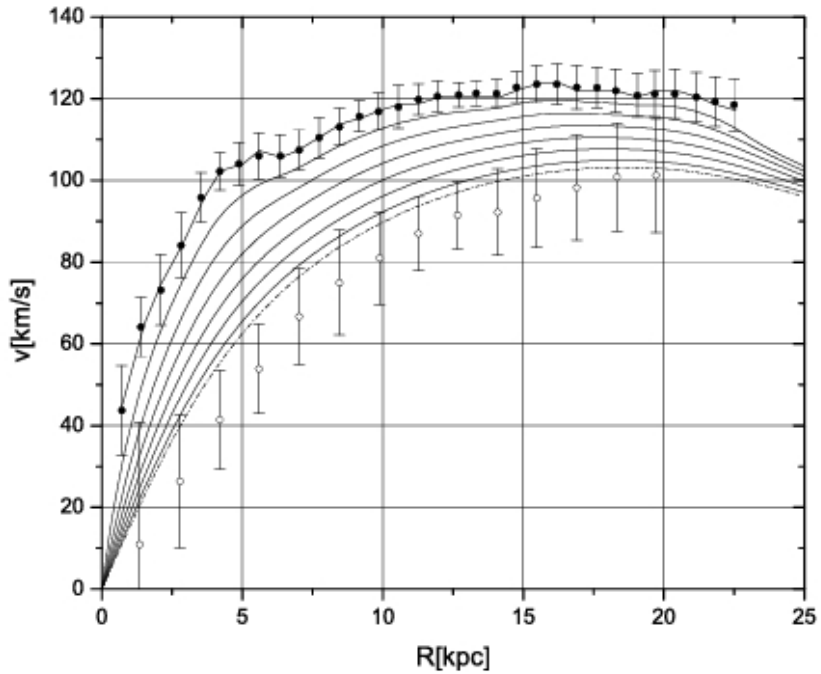


Figure 3. Galaxy NGC 4559: disc rotation curve (solid circles) and the anomalous gas rotation curve above the disk (open circles), both from Barbieri et al (2005). The solid lines are rotation curves predicted by our model at various heights above the mid-plane at $z = 0.6, 1.2, 1.8, 2.4, 3.0$ and $3.6\,\mathrm{kpc}$. The dashed line is the rotation curve predicted at $z = 4\,\mathrm{kpc}$.

Jałocha et al., (2011) MNRAS 412: 331-336

Mikrosoczewkowanie grawitacyjne

S. Sikora et al.: Gravitational microlensing as a test of a finite-width disk

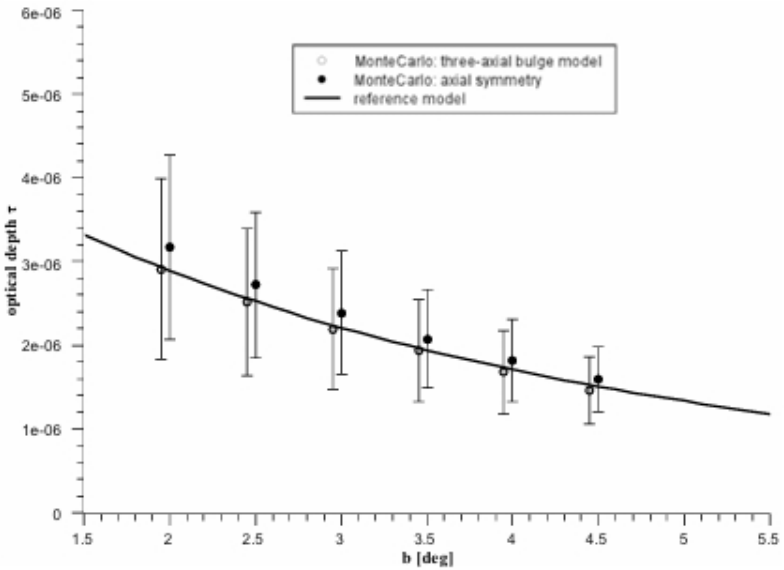


Fig. 10. Monte Carlo simulation of the optical depth (and the standard deviation) in the axisymmetric case (solid circles and bars) and in the presence of a three-axial bar (open circles and bars). The solid line represents the model curve based on the integral (2), in which case the sources of light lie on the symmetry axis.

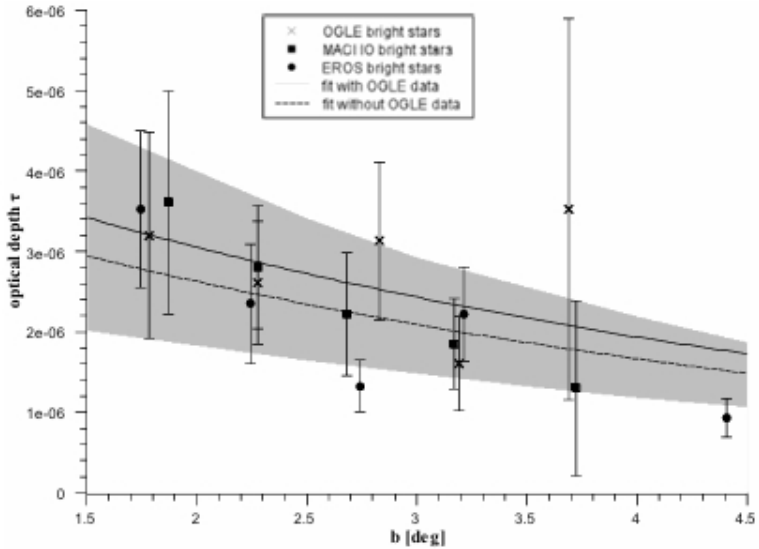
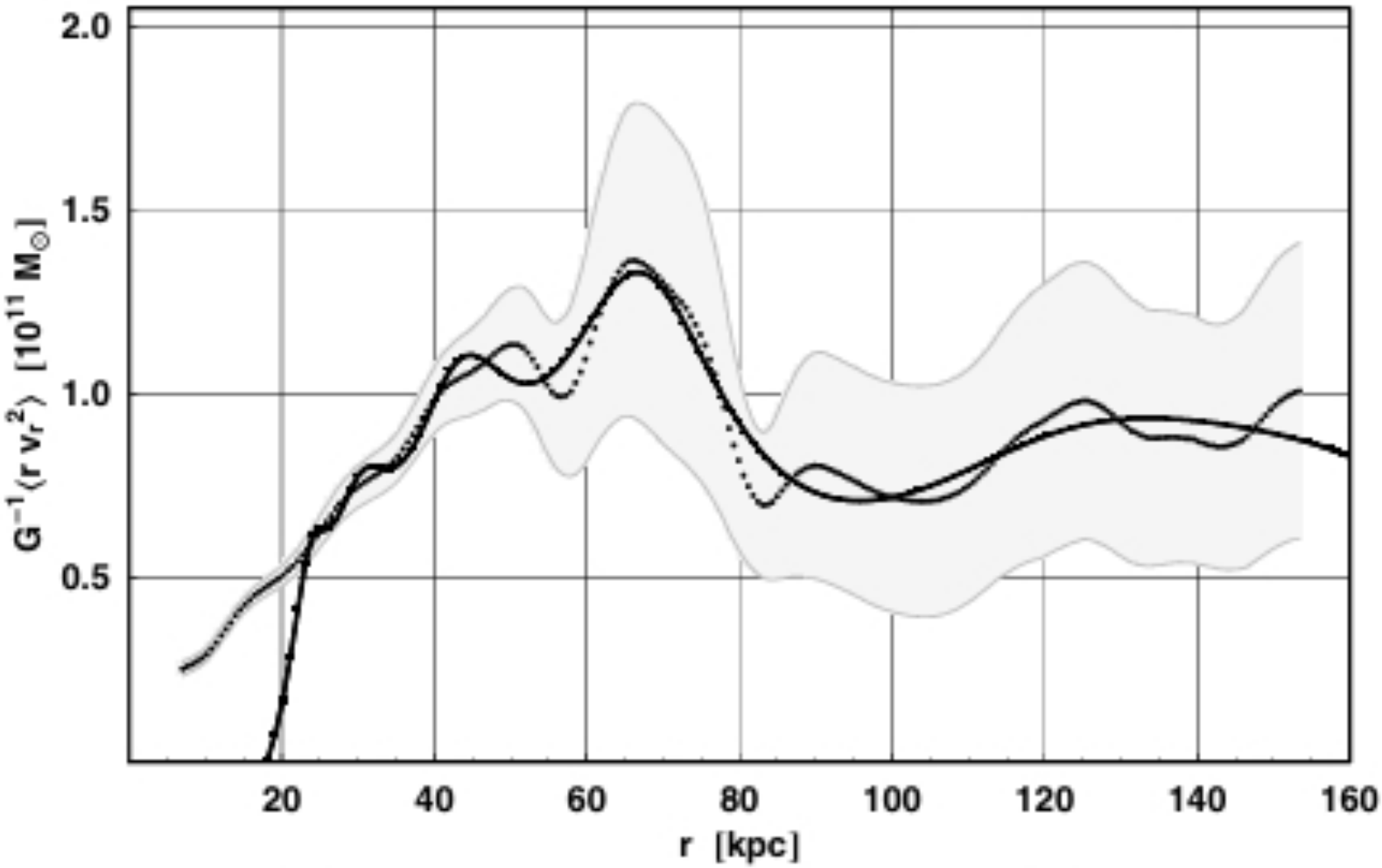


Fig. 11. $(1 - f)\, c_1 \exp(-c_2 \mid b \mid) \times 10^{-6}$ fit to the OGLE, MACHO, and EROS bright stars optical depth data (solid line) and a similar fit to the narrowed data of MACHO and EROS bright stars data (dashed line). The filled area corresponds to the standard deviation range of the Monte Carlo simulation (including bar) described in the previous section. The $c_1 \exp(-c_2 \mid b \mid) \times 10^{-6}$ curve is not plotted for clarity.

Sikora et al., A&A546,A126(2012) $M_{dark}(r < 8kpc) = 0.1 \times 10^{10} M_{\odot}$

Obiekty halo Drogi Mlecznej



Bratek et al., A&A562,A134(2014) $M{=}1.4{\times}10^{11} M_\odot$

Nowe dane z teleskopu Gaia

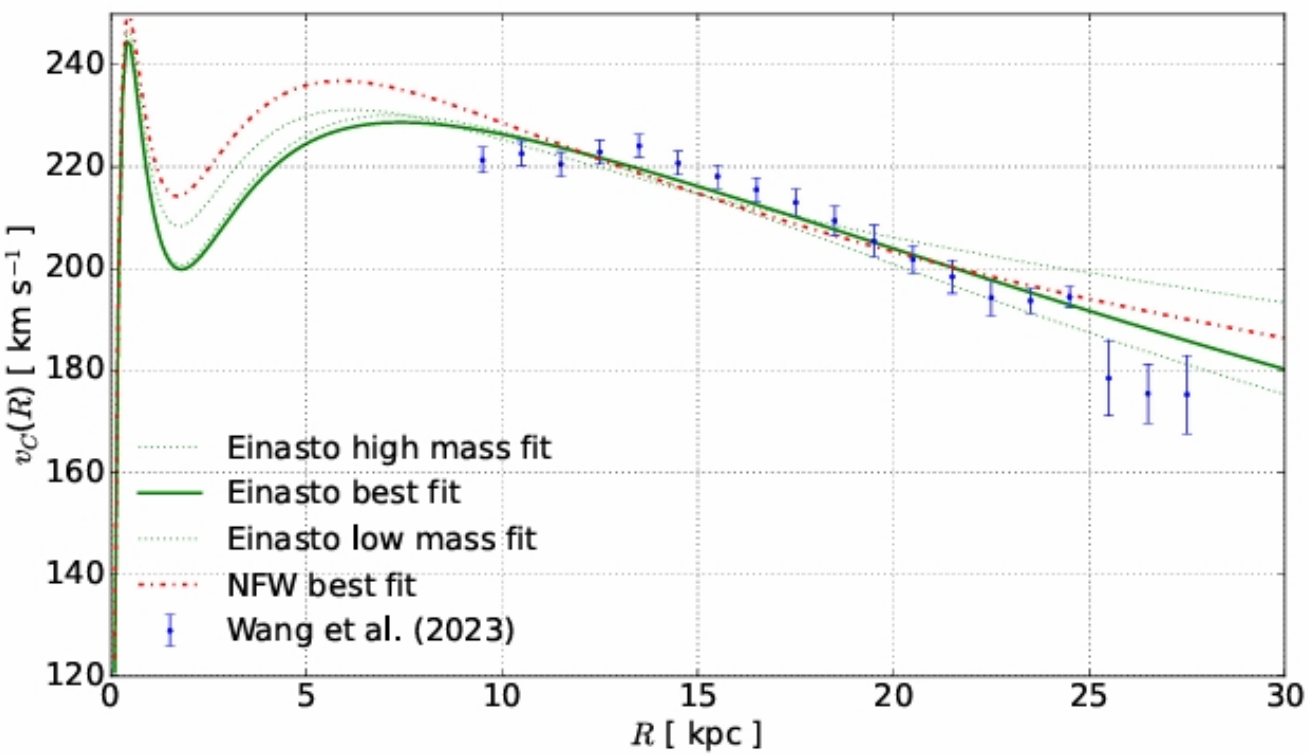


Figure 1. Rotation curve from *Gaia* DR3 (points and error bars Wang et al. 2023), Einasto profile fits (solid and dotted lines) and NFW best fit (dash-dotted line)

Yongjun Jiao et al., arXiv:2306.05461 $M{=}2.75{\times}10^{11}\,M_{\odot}$

Nowe dane z teleskopu Gaia

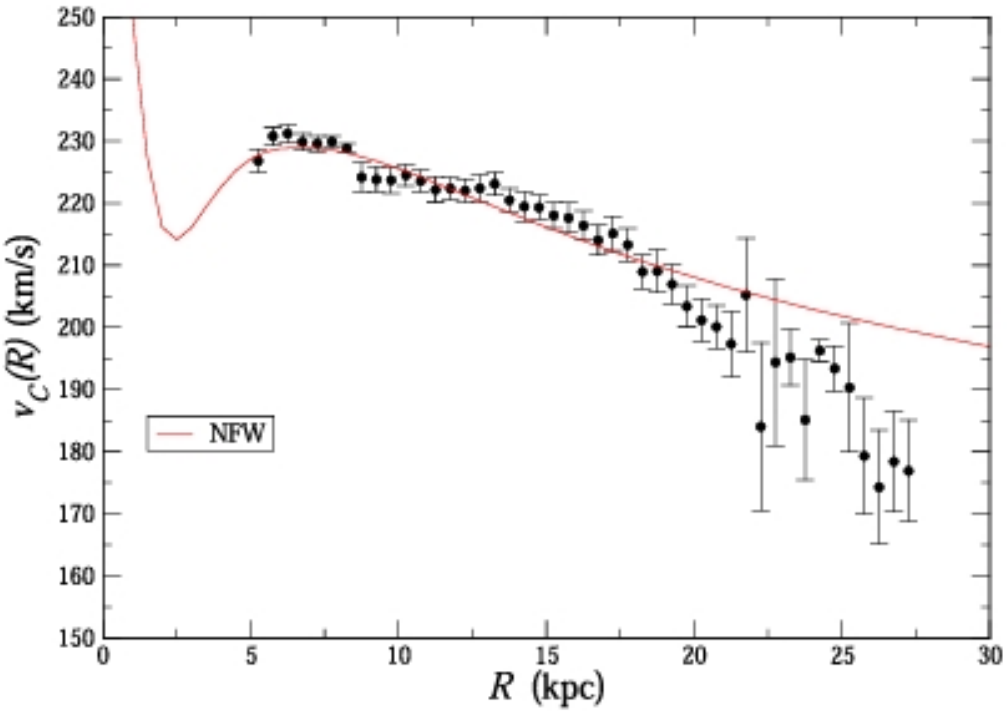


Figure 2. Best fit of the NFW mass model to the rotation curve given in Table 1 (DR3+ determination of the rotation curve).

Labini et al., 2023 ApJ 945 3 model halo NFW M=$6.5\times10^{11} M_\odot$

Nowe dane z teleskopu Gaia

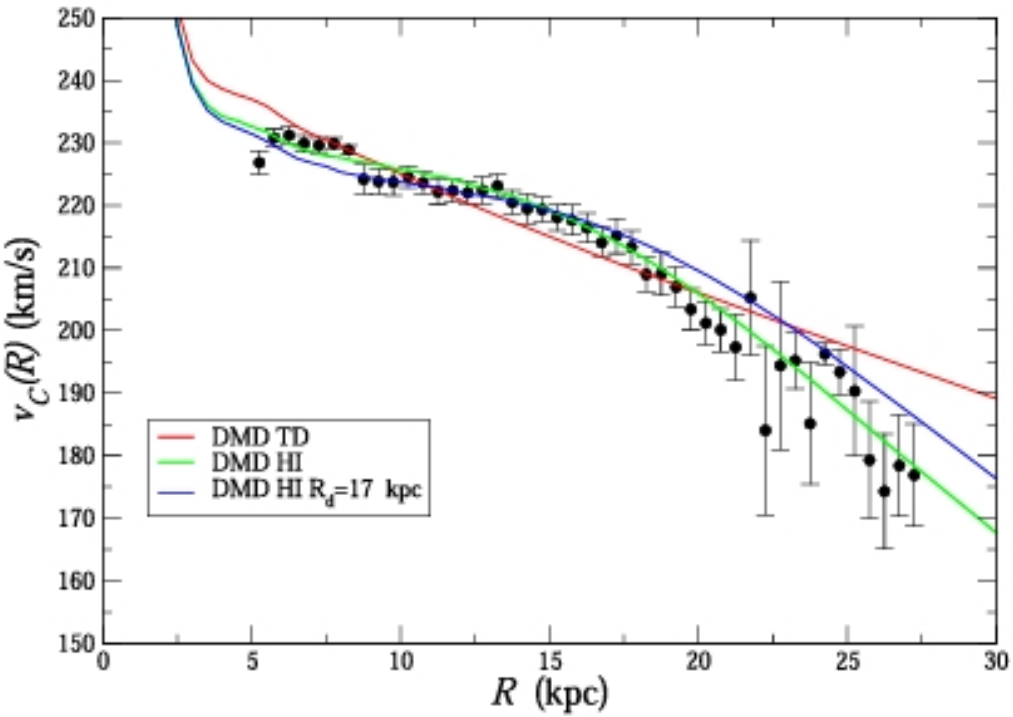


Figure 3. Best fit of the DMD mass model (i.e., Equation (7)) to the rotation curve given in Table 1 (DR3+ rotation curve). We show results for an exponentially decaying surface mass on a thin disk (Equations (8)–(9)), the case in which the surface density is given by Equation (10) with R_d and M_d as free parameters and the same but with $R_d = 17$ kpc (corresponding to the value measured for the distribution of Galactic H I) and only the DM disk's mass M_d as a free parameter.

Labini et al., 2023 ApJ 945 3 "dark matter disk model" M=$1.6\times10^{11} M_\odot$

Dziękuję za uwagę!