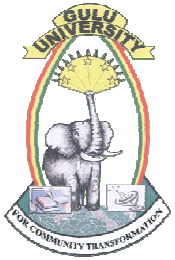
Course of General Astronomy



Gulu University

Naples FEDERICO II University

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Mass of Andromeda Galaxy

Radial Velocity (along L. of S.) at various distances from the center of Andromeda Galaxy

Dist. ′	V Km/s	Dist. ′	V Km/s	Dist. ′	V Km/s	Dist. ′	V Km/s
-120	-460	-15	-340	+2	-250	+28	-120
-100	-500	-13	-340	+6	-220	+29	-120
-96	-530	-10	-310	+5	-210	+46	0
-80	-600	-8	-350	+4	-205	+66	+70
-65	-580	-7	-330	+10	-260	+70	+60
-70	-570	-6	-370	+12	-250	+80	+100
-50	-530	-3	-360	+12	-210	+96	+80
-29	-480	-3	-340	+14	-180	+100	+30
-30	-440	-2	-305	+15	-180	+107	-50
-25	-415	+8	-290	+16	-170	+120	-50
-20	-390	+5	-280	+22	-125		
-16	-360	+2	-250	+21	-100		

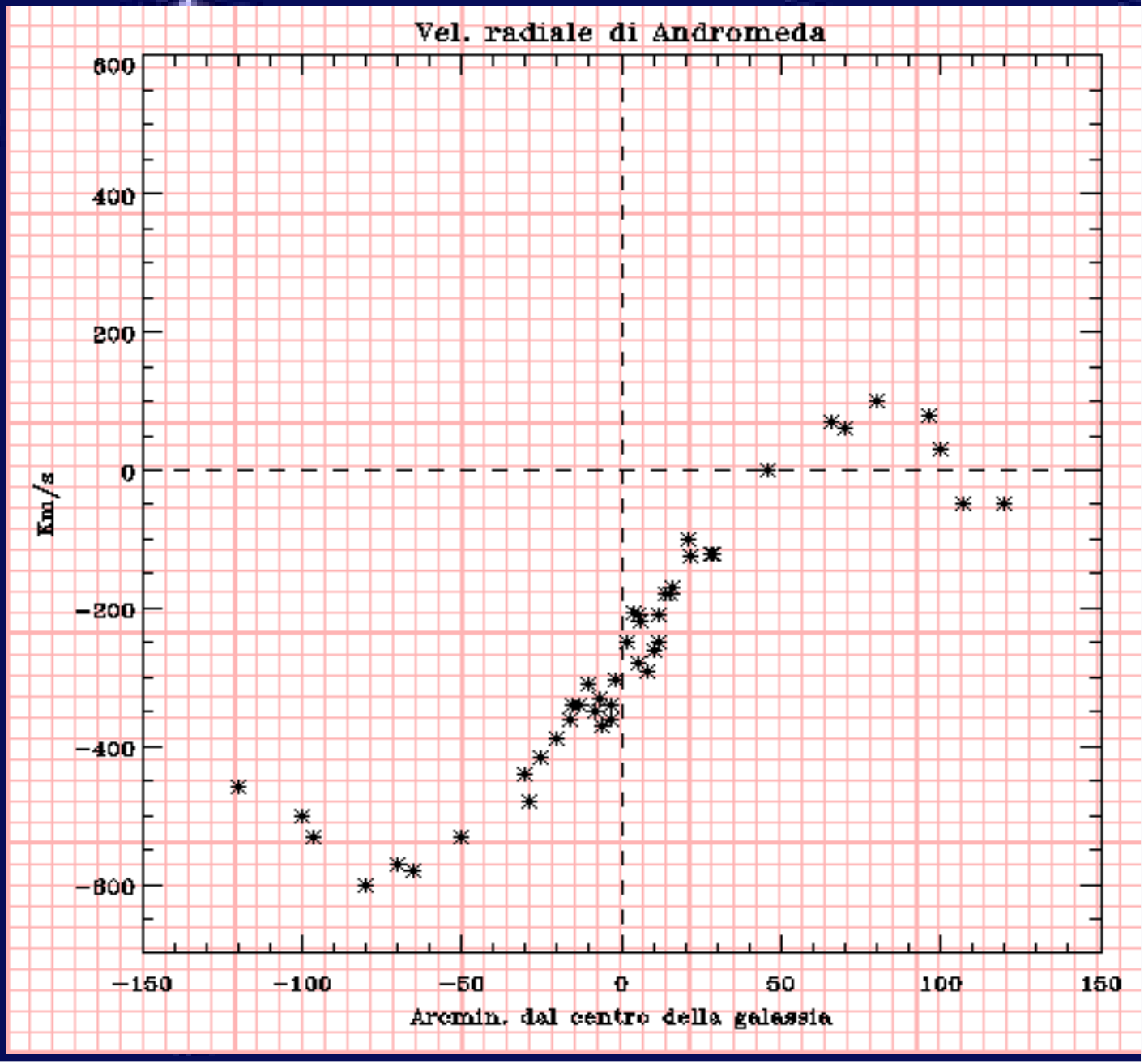
Can you see some strange behaviour ??

Plot of experimental data

Excess of approaching velocities

Why ??

Center of Mass motion (relative velocity Sun - galaxy)



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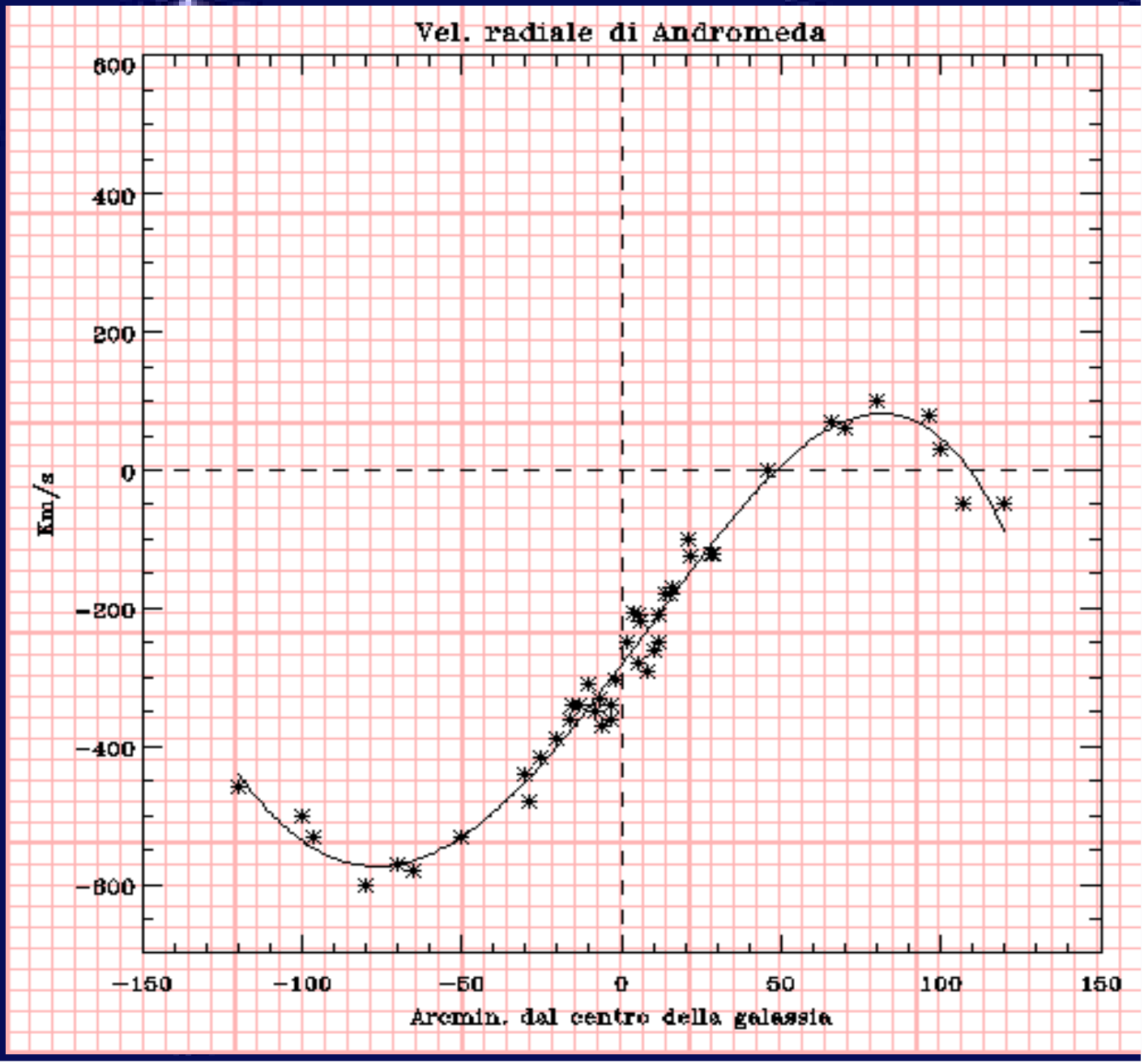
Play attention to the mean value !



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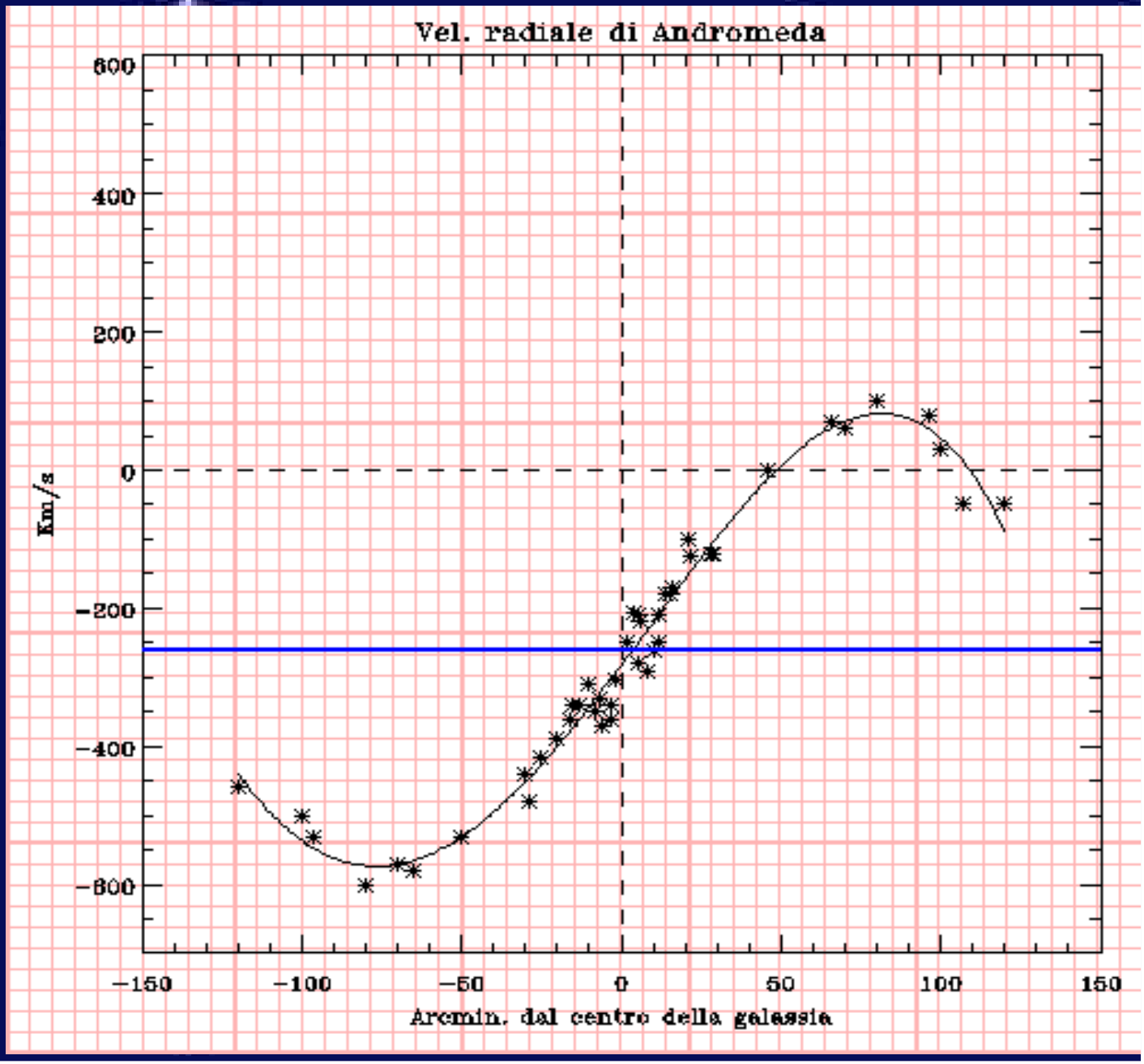
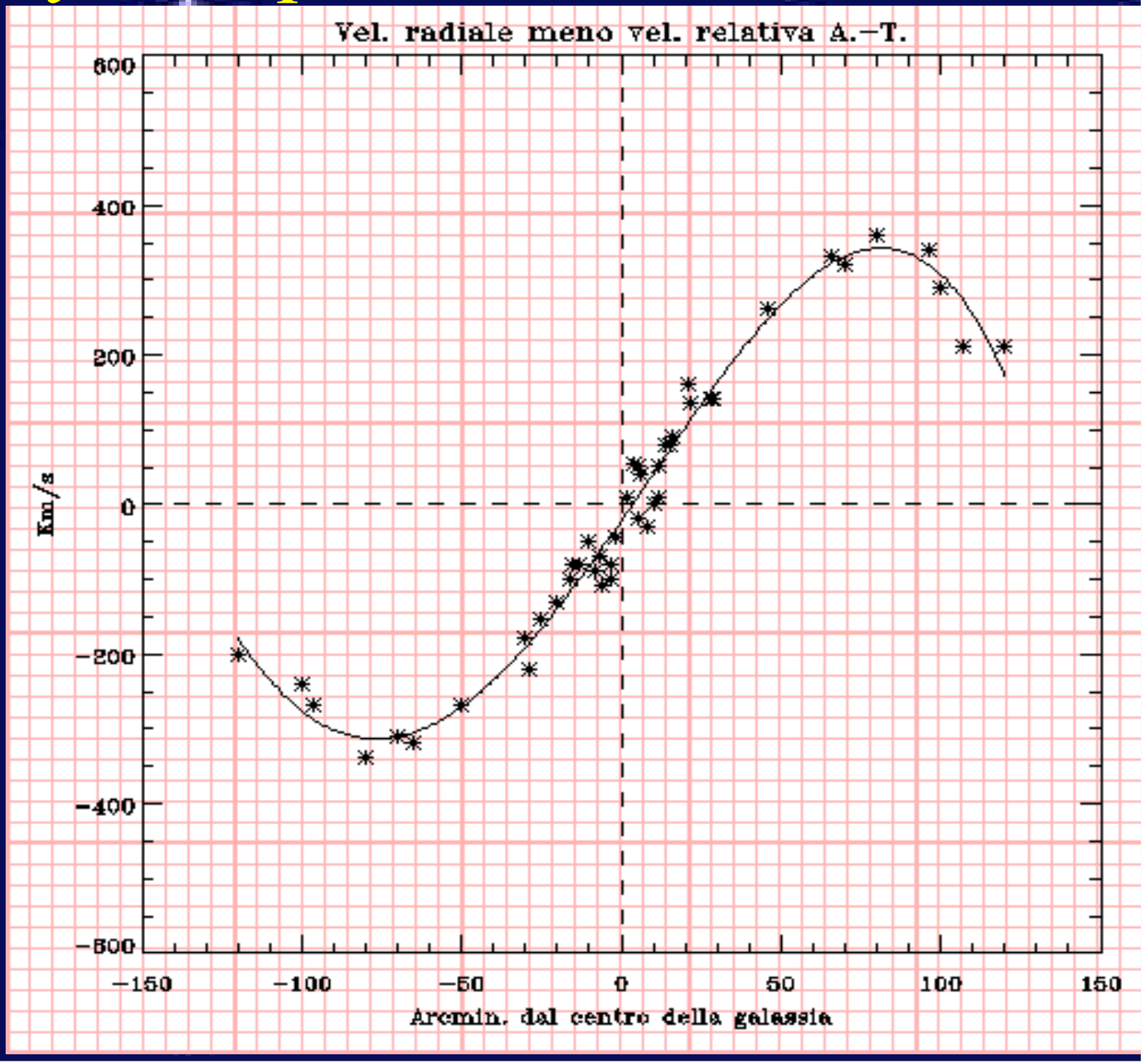


Rotation Velocity Component

Why this strange behaviour ?



Involved Concepts Nodes:

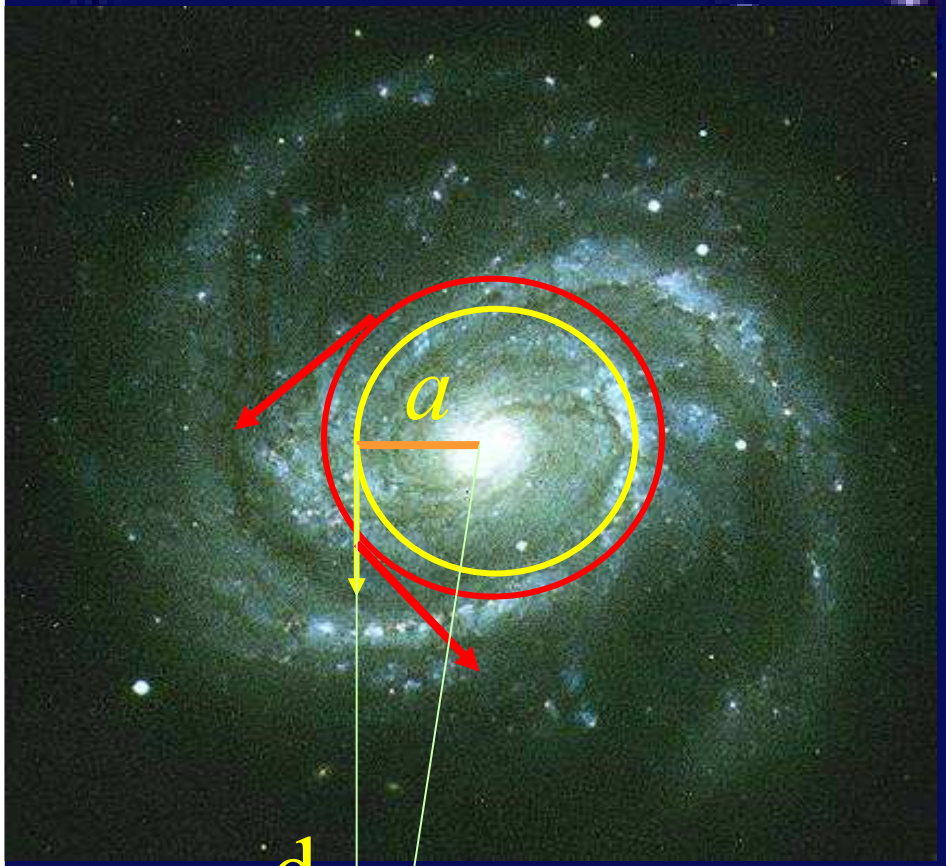
1) velocity along the Line of Sight (radial)

2) angular distance

3) rotation model

.... (Keplerian motion)

Radial Velocity



$a = d\alpha'/3437.7$

III Kepler's Law

$T^2=(2\pi)^2 a^3/GM_a$

$$V_a = 2\pi a / T = 2\pi a / 2\pi a\sqrt{a / GM_a} = \sqrt{GM_a / a}$$

The strange behaviour:

constant density *(model)*

$M_a=(4/3)\pi\rho a^3 \Rightarrow$ $$V_a = \sqrt{\frac{4}{3}\pi a^3 \rho G / a} = a\sqrt{\frac{4}{3}\pi\rho G}$$

when the galaxy is ended $M_a = M_{Andr}$

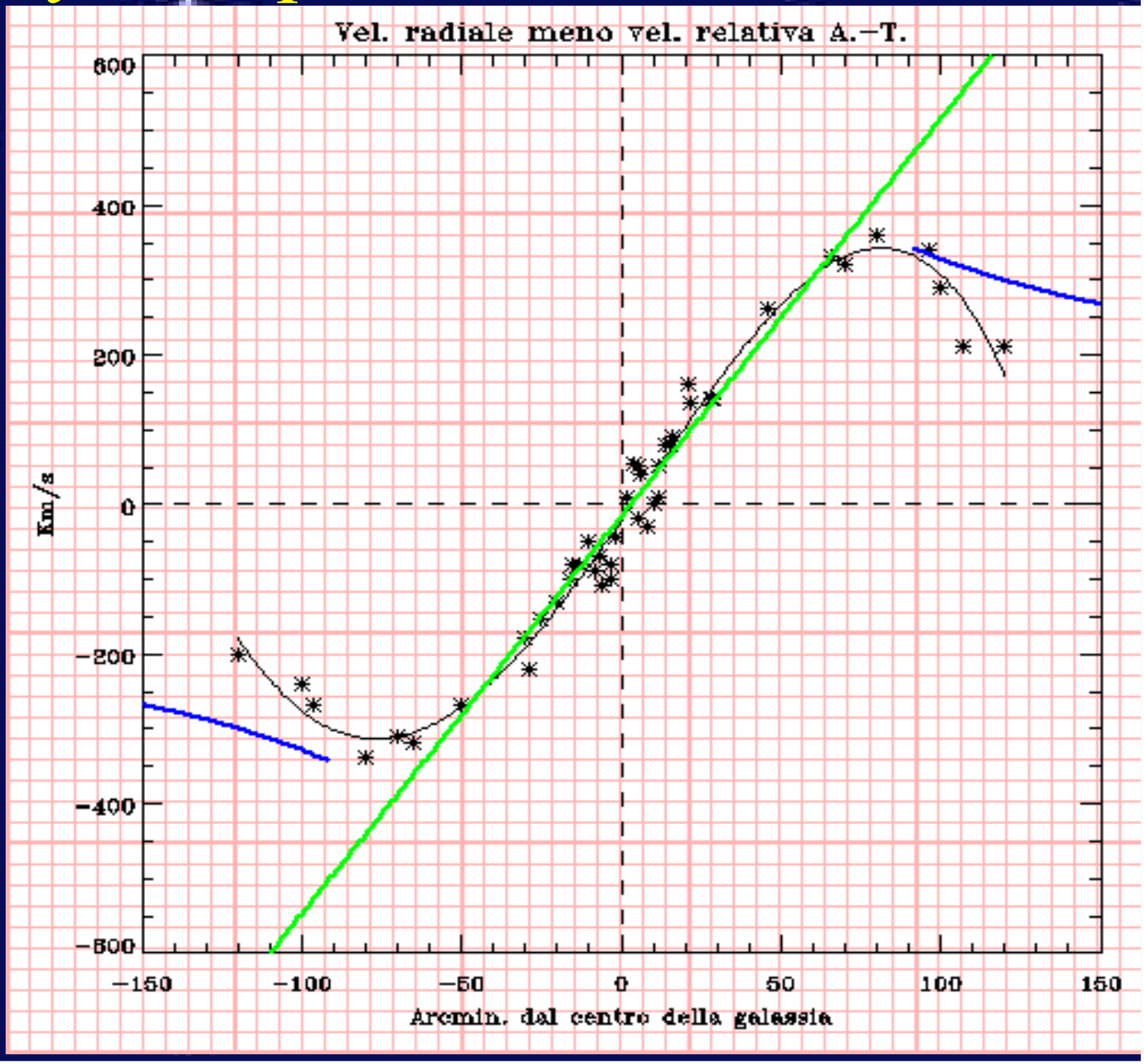
$\Rightarrow$ $$V_a = \sqrt{GM_{Andr} / a} = \sqrt{GM_{Andr}}\sqrt{\frac{1}{a}}$$

Rotation Velocity Component

The reason for strange behaviour :

Green: linear dependence from distance (densità cost.)

Blue: region inverse square of distance (galaxy ended)

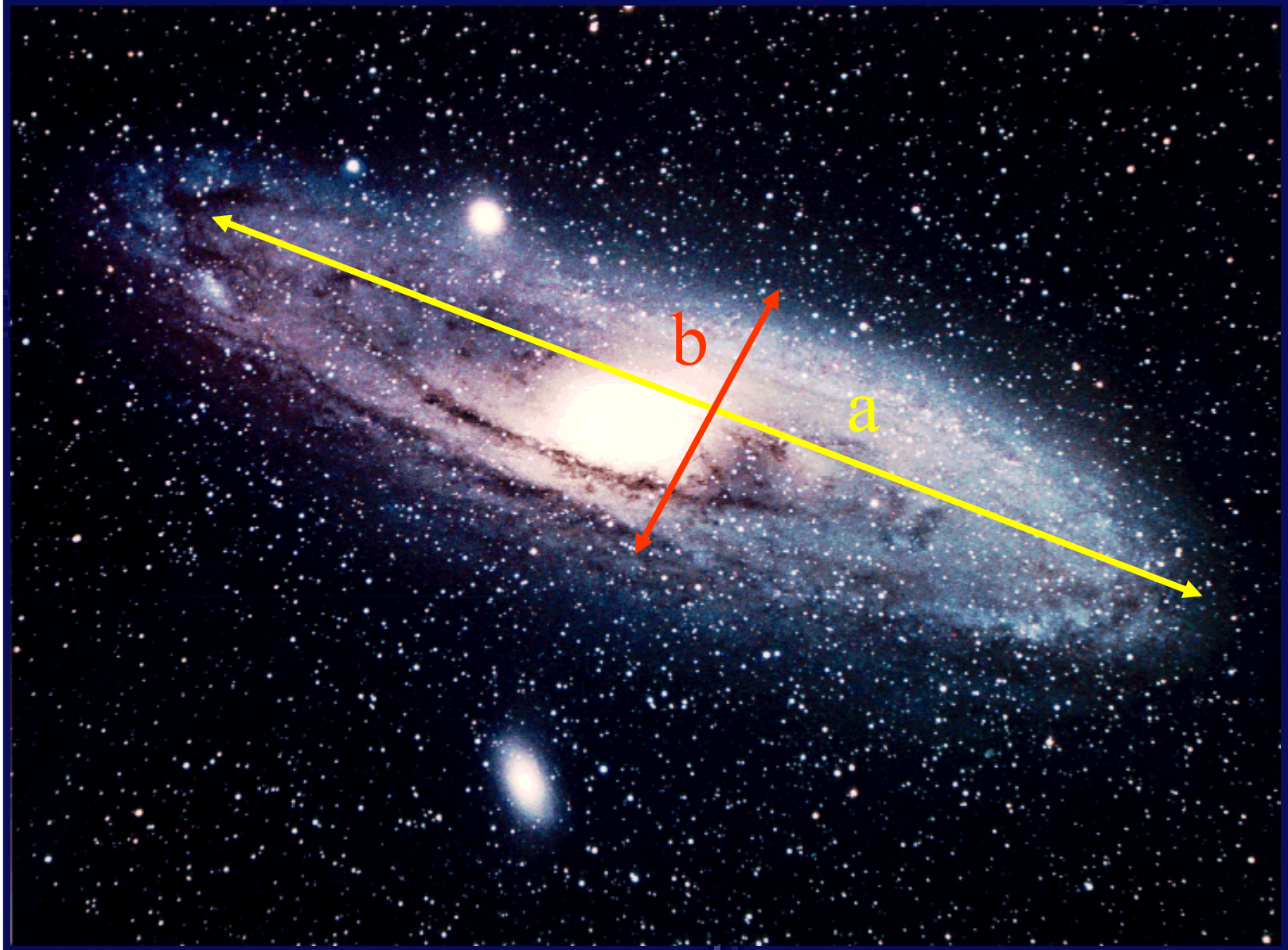


You have to select region having $M_a \approx M_{Andr}$

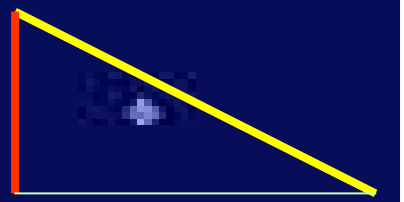
M_{Andr}: excess o defect determination ?

Did you see an Andromeda galaxy imagine ?

There is :



model:
circular
disk
galaxy



V_{obs}

V_{real}

Steps

1. Data plot
2. Linear fitting of central part: CM vel.
3. Selection of appropriate regime for M_a
4. Use of galaxy both side (mean value)
5. Mass estimation
6. Excess or defect determination ?
7. Explain *(shortly)* the used methods