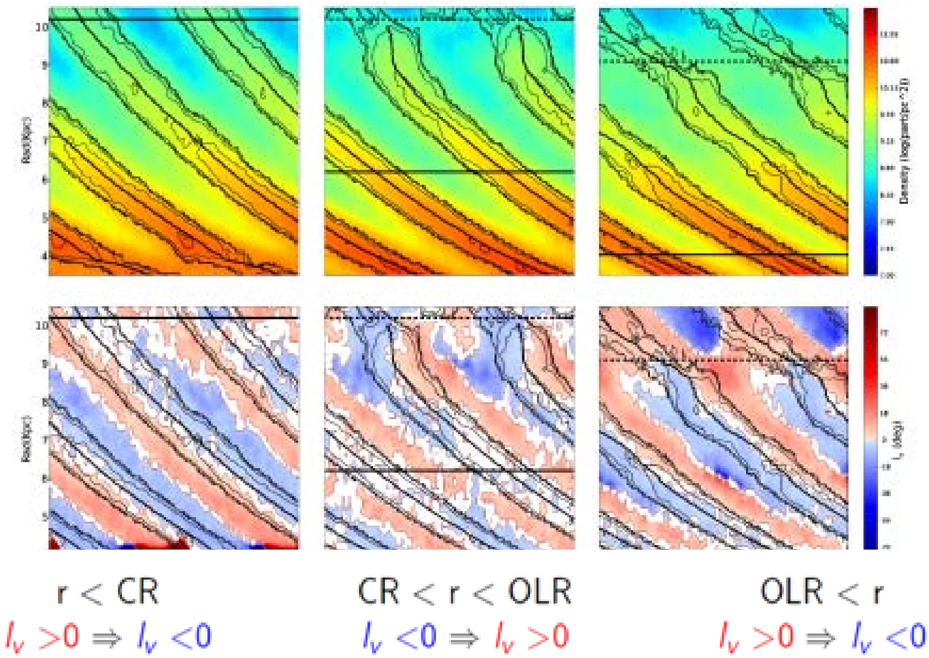
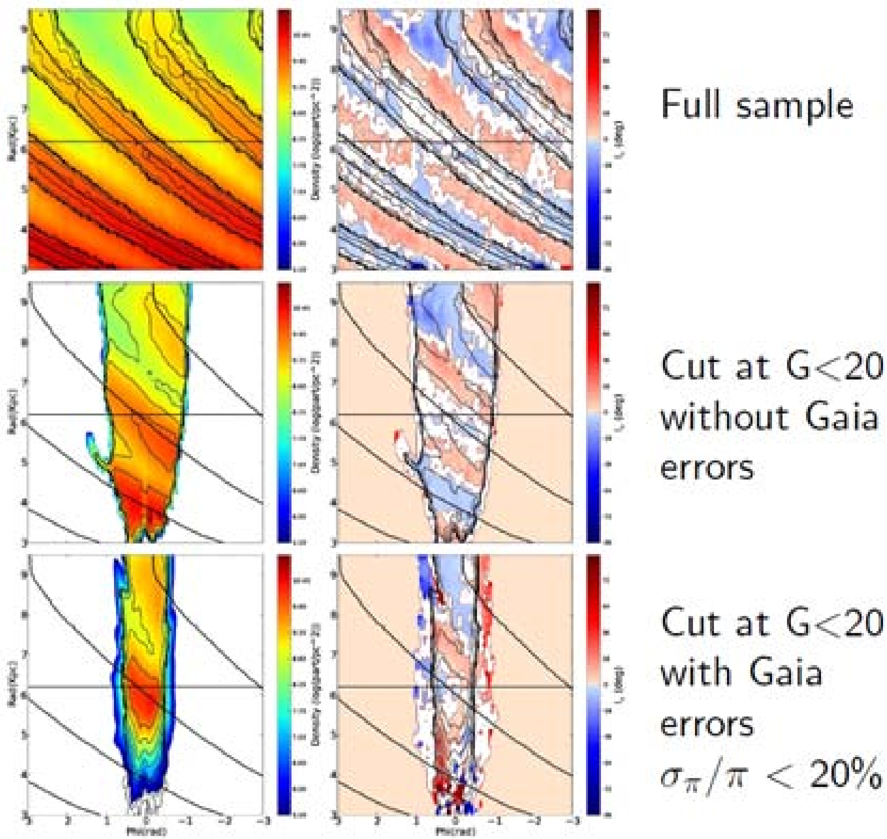
A novel method to bracket the corotation radius in galaxy disks: vertex deviation maps

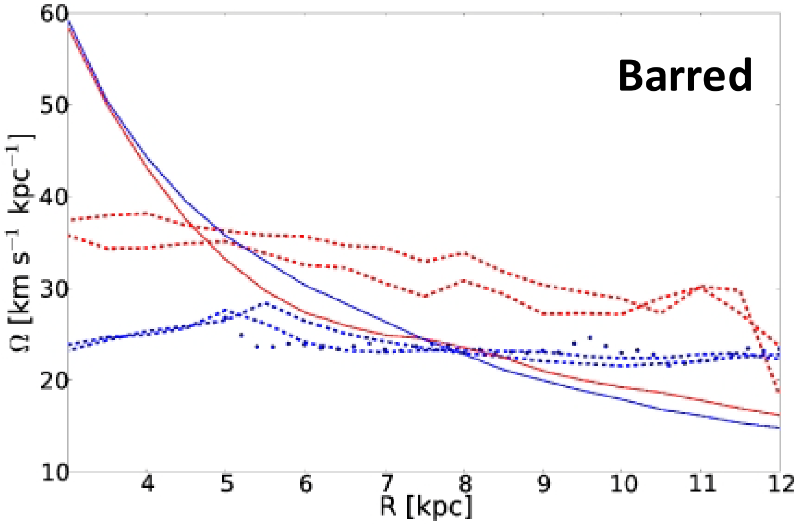
S. Roca-Fabrega, T. Antoja, F. Figueras, O. Valenzuela, M. Romero-Gomez and B. Pichardo (2014, MNRAS)

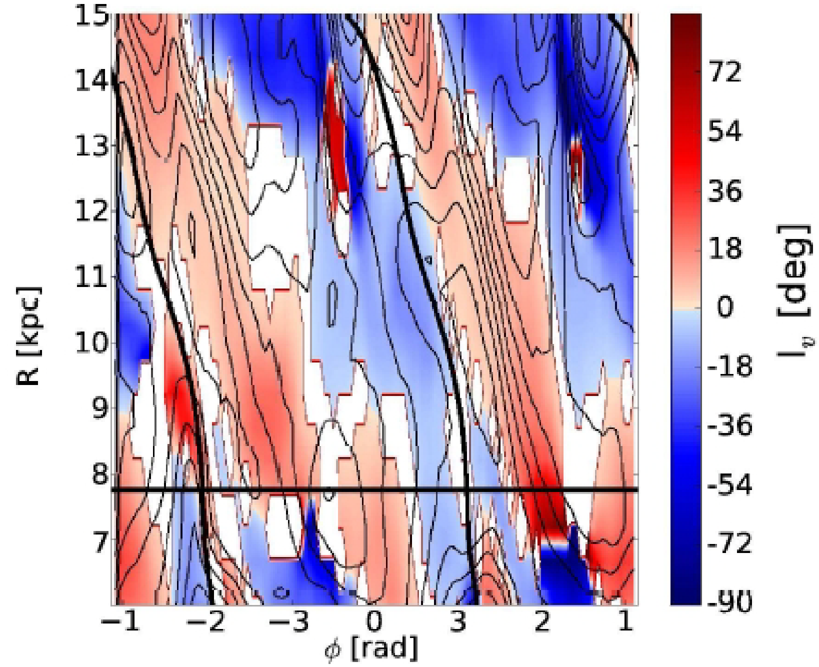


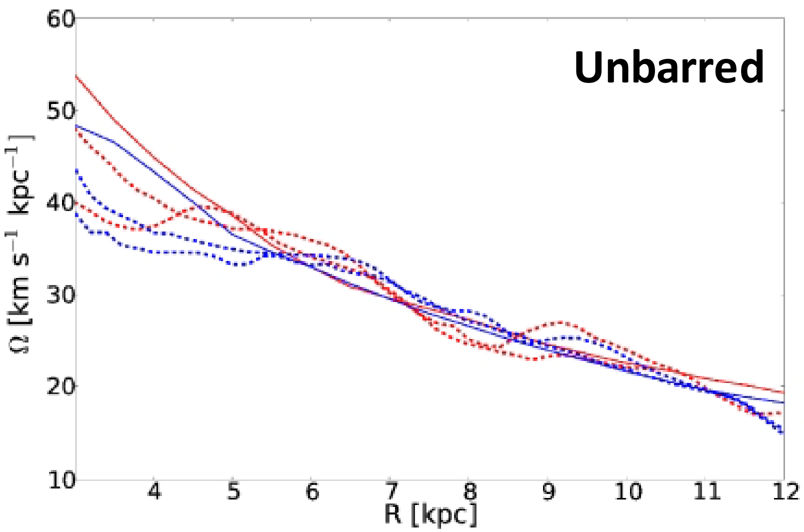


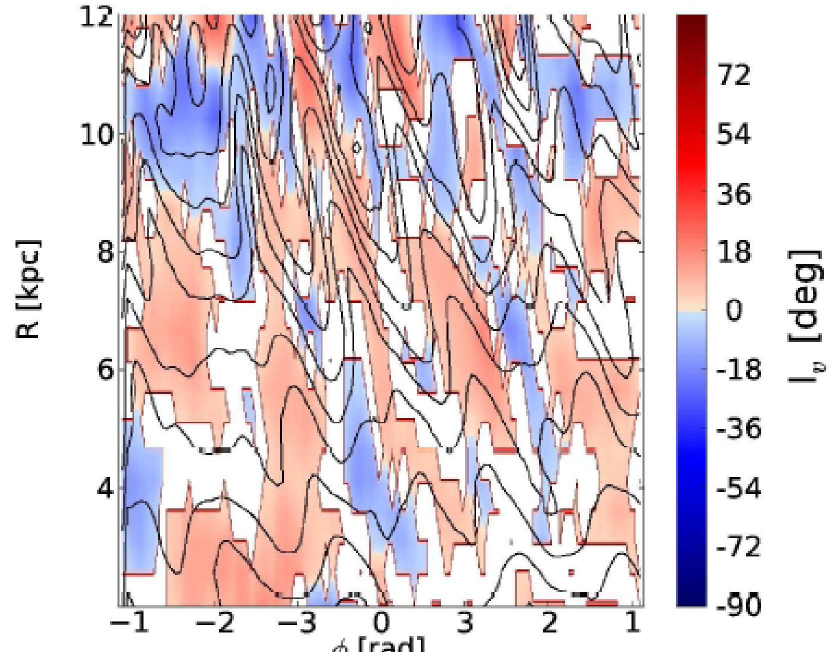
- New method to determine the CR and OLR radius based on changes in lv sign when crossing density perturbations.

- Lv distribution in a TWA spiral arms test particle model with 5·10^6 particles, assuming all are A0 stars (full sample, cut at G<20, cut at G<20 and relative error in parallax < 20%).







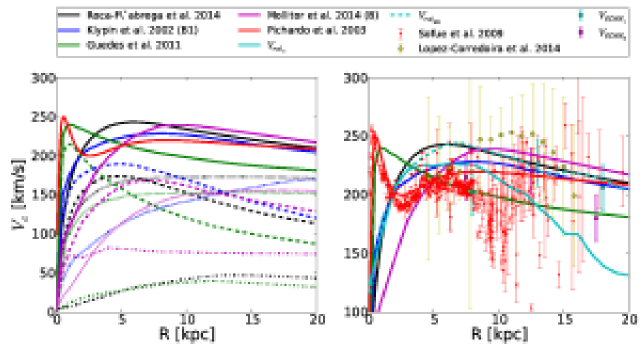


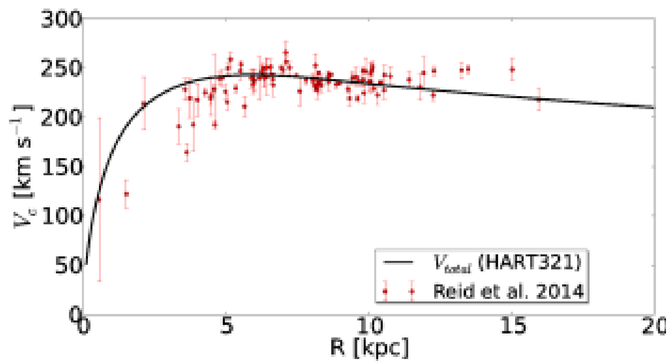
Roca-Fàbrega et al, 2013

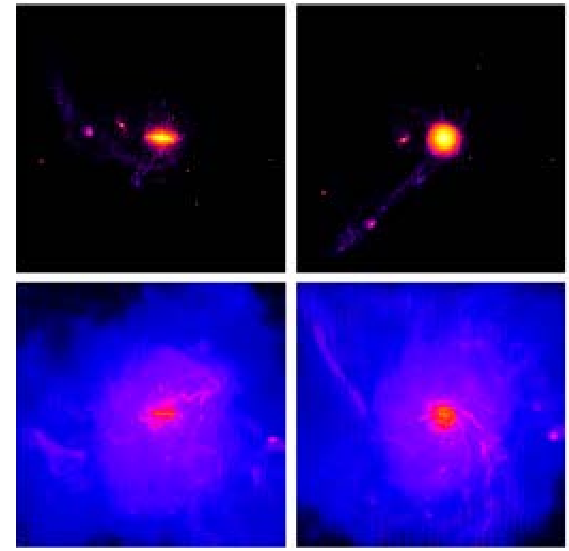
New MW like simulation in a cosmological context

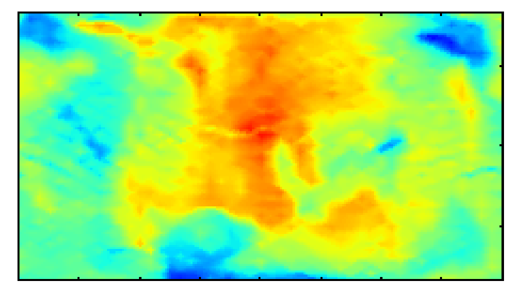
S. Roca-Fabrega, O. Valenzuela, F. Figueras, Y. Krongold and P Colín

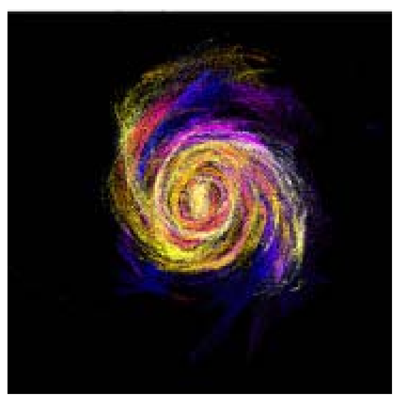
- Realistic MW like simulation
- Two bars one young, one old, misaligned 90º
- Highly anisotropic hot gas distribution
- Kinematical and dynamical analysis of spiral arms and bars, with and without Gaia errors are being prepared

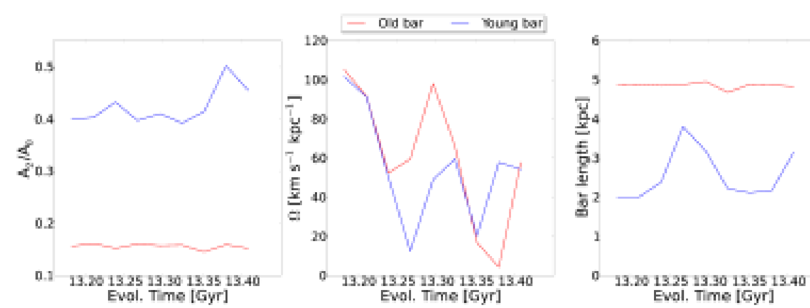






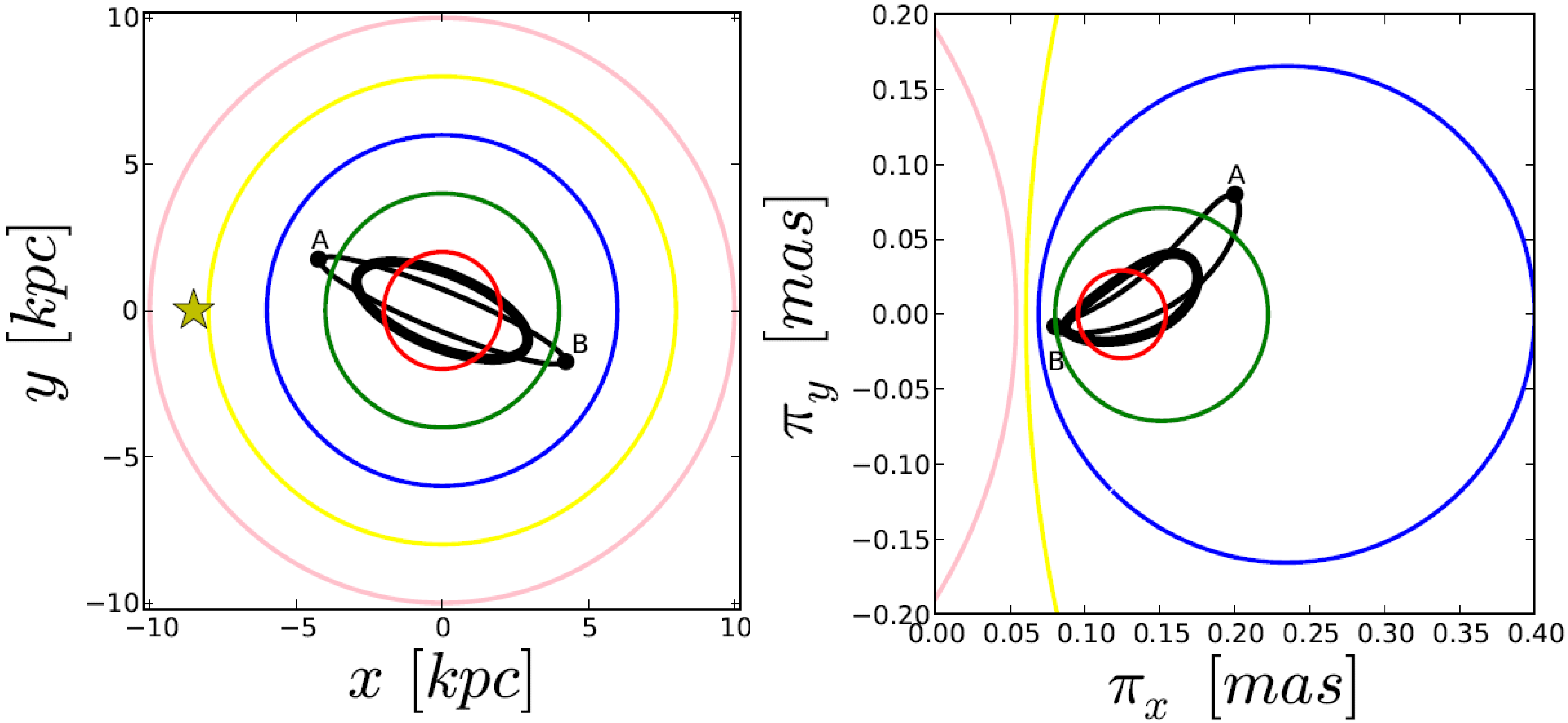






Does our Galaxy have one/two bars?

work in the space of the observables!

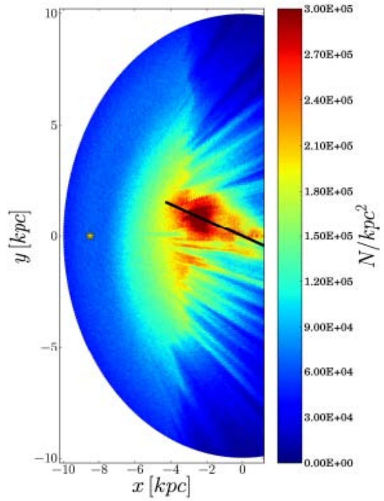


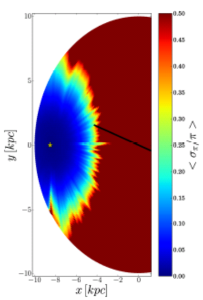
distances parallaxes

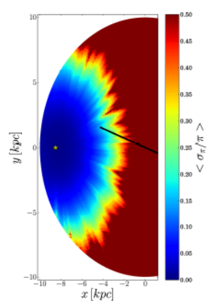
Romero-Gómez, Aguilar et al.

The analysis of realistic Stellar Gaia mock catalogues. I. Red Clump stars as tracers of the central bar

Romero-Gómez, Figueras, Antoja, Abedi & Aguilar (submitted to MNRAS, 2014)

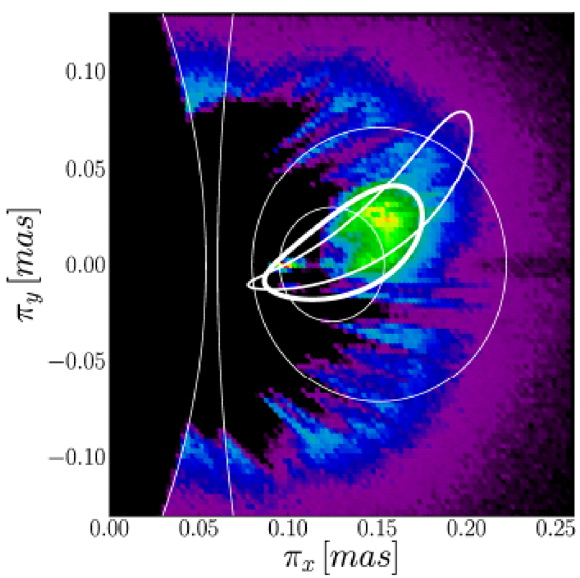




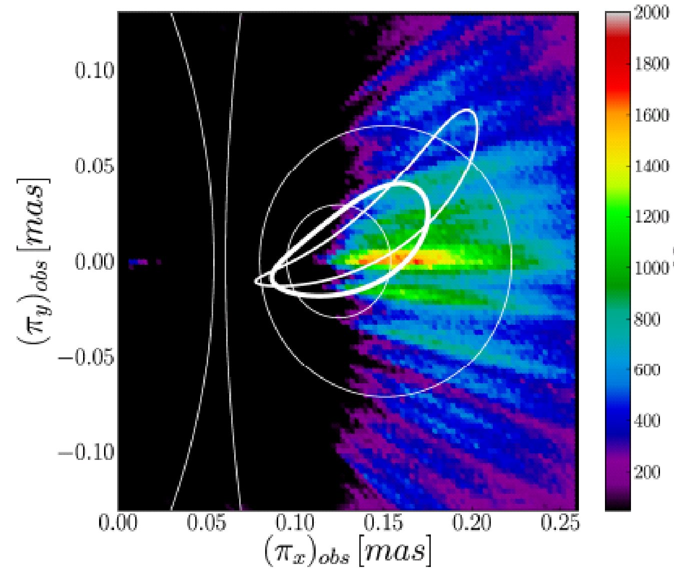


Test particle simulations in a 3D barred galaxy model.
RC characteristics
Cut to Gaia G 20
+ we convolve with the Gaia error model

Working in the space of Gaia observables $(\pi_x, \pi_y) = (\pi\cos(l), \pi\sin(l))$

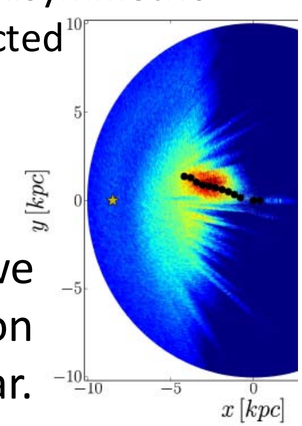


No errors, axisymmetric component subtracted



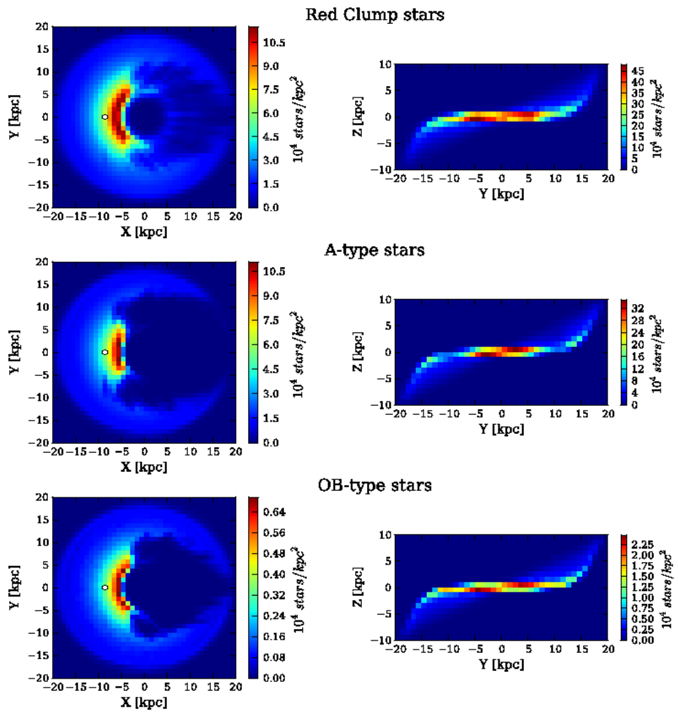
With Gaia errors, axisymmetric component subtracted

If we use IR photometric distances, we can determine the angular orientation of the Galactic bar.

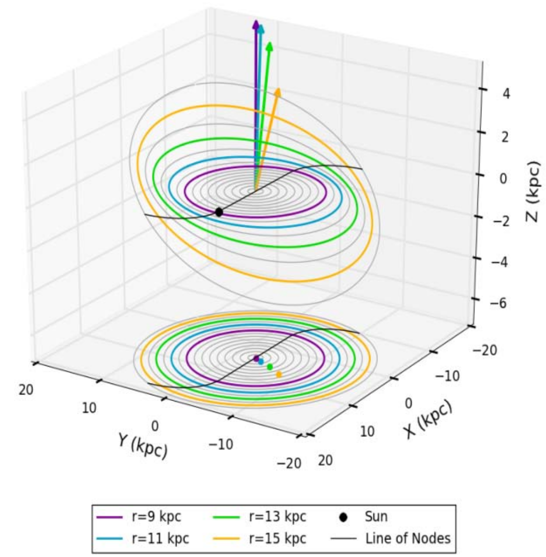


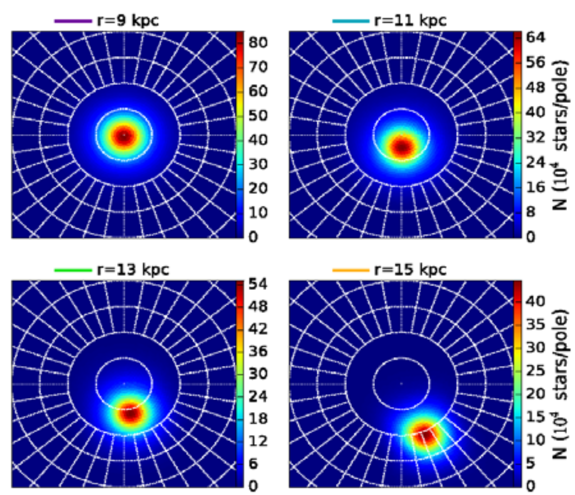
Characterizing the Galactic warp with Gaia: I. The tilted ring model with a twist

H. Abedi, C. Mateu, L.A. Aguilar, F. Figueras , Romero-Gomez, M.



We use random realization of test particles which evolve in a 3D Galactic potential whose disc is warped adiabatically.





A family of Great Circle Cell Counts (GC3) methods is used to measure the tilt and twist angle of the warp. Even after considering Gaia selection function and its error, the warp geometry can be recovered.

Gaia error model
(after commissioning)

Astrometric error model

- Before commissioning: error in parallax modelled by:

$$\sigma_\pi \,[\mu as] = (9.3 + 658.1 \cdot z + 4.568 \cdot z^2)^{1/2} \cdot [0.986 + (1 - 0.986) \cdot (V\text{-}I_C)],$$

where

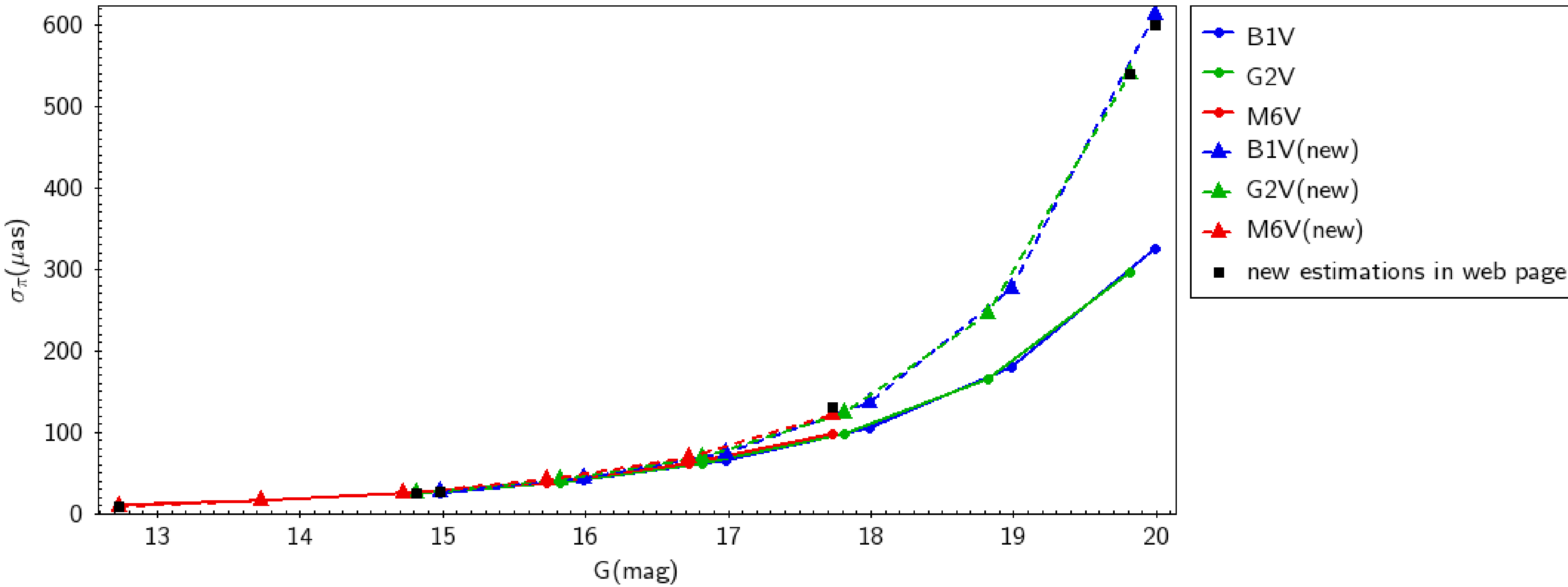
$$z = \mathrm{MAX}[10^{0.4 \cdot (12 - 15)}, 10^{0.4 \cdot (G - 15)}],$$

- After commissioning: the science performace webpage provides (only stray light):

	B1V	G2V	M6V
$V\text{-}I_C$ [mag]	-0.22	0.75	3.85
Bright stars	5-14 μas (3 mag < V < 12 mag)	5-14 μas (3 mag < V < 12 mag)	5-14 μas (5 mag < V < 14 mag)
V = 15 mag	26 μas	24 μas	9 μas
V = 20 mag	600 μas	540 μas	130 μas

Astrometric error model:

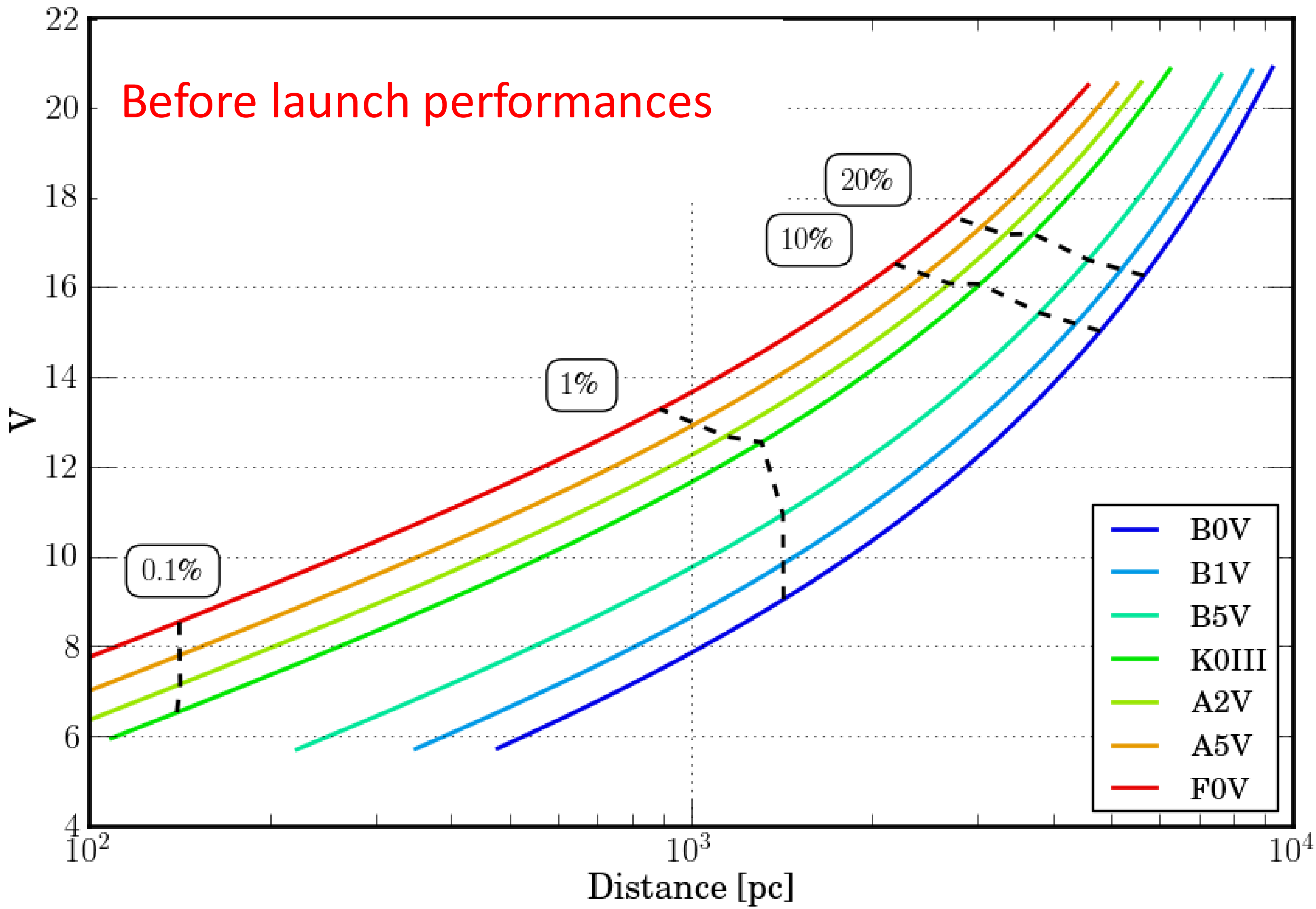
New fit provided by Kazi, Antoja, DeBruijne (Oct. 2014)



New coefficients, assuming that the stray light does not affect the dependence on the colour: -11.5, 706.1, 32.6

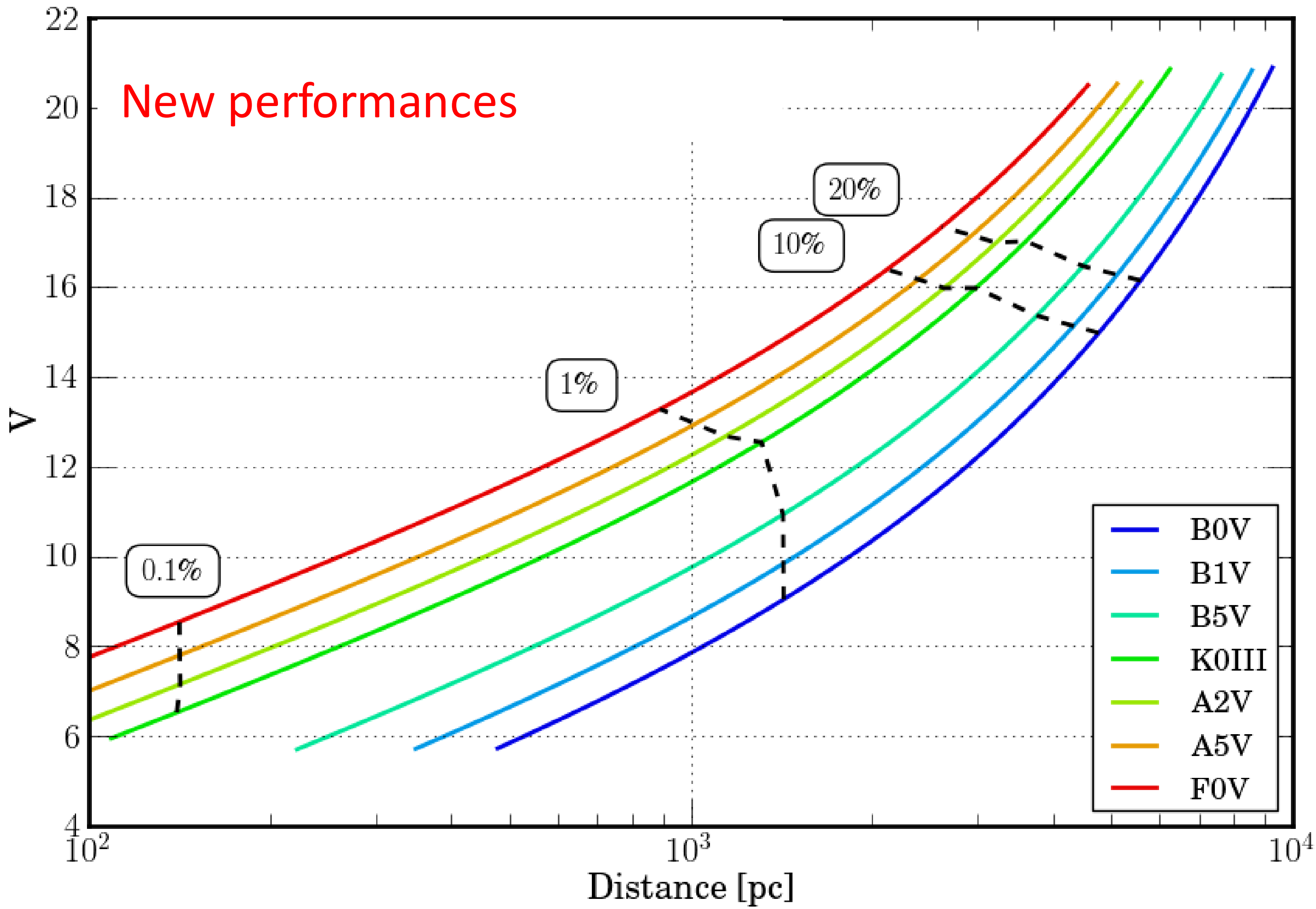
$$\sigma_\pi \text{ [}\mu\text{as]} = (9.3 + 658.1 \cdot z + 4.568 \cdot z^2)^{1/2} \cdot [0.986 + (1 - 0.986) \cdot (V\text{-}I_C)],$$

Gaia Parallax accuracy – 1mag/kpc extinction – disk



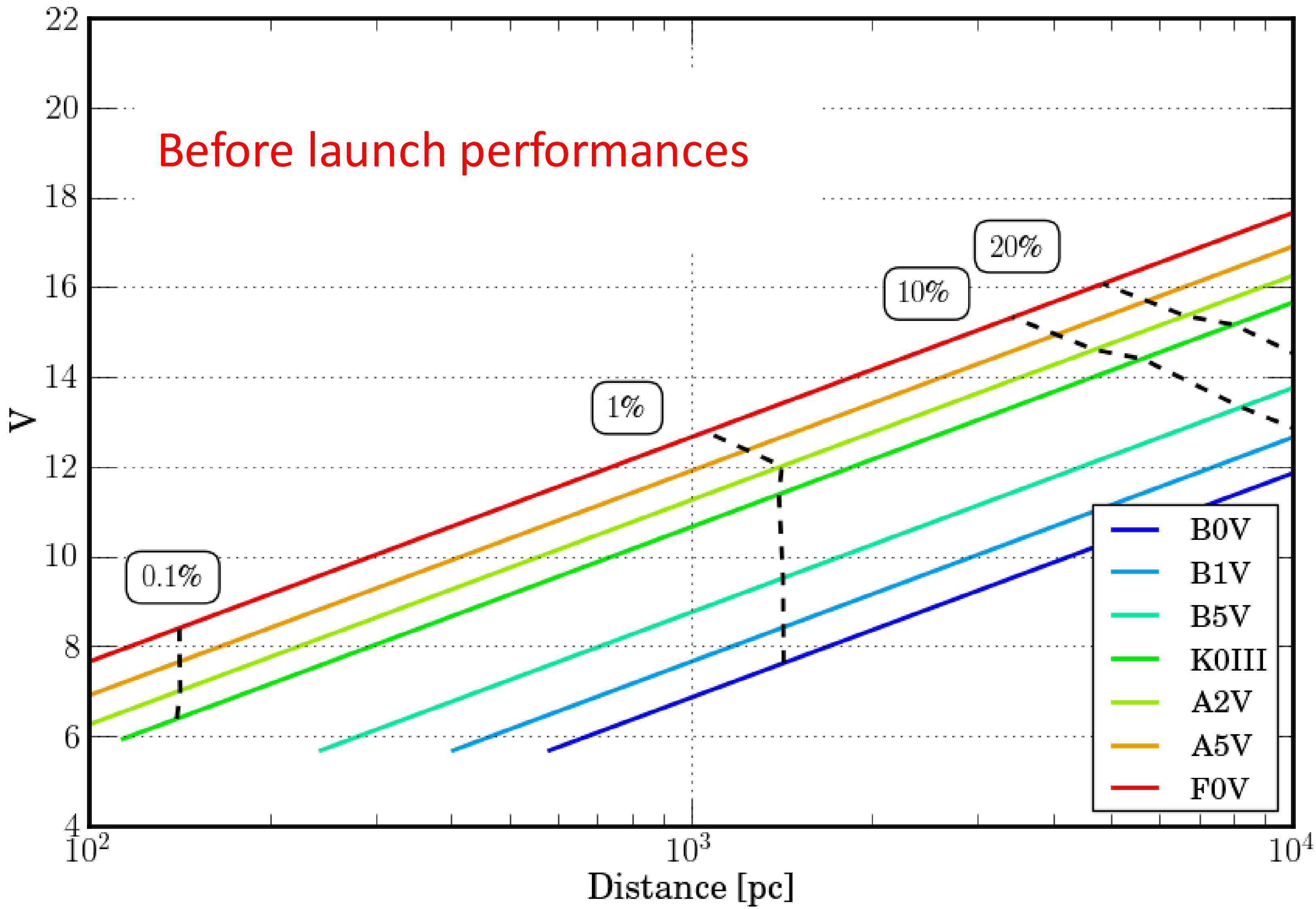
Code provided by A. Brown

Gaia Parallax accuracy – 1mag/kpc extinction – disk



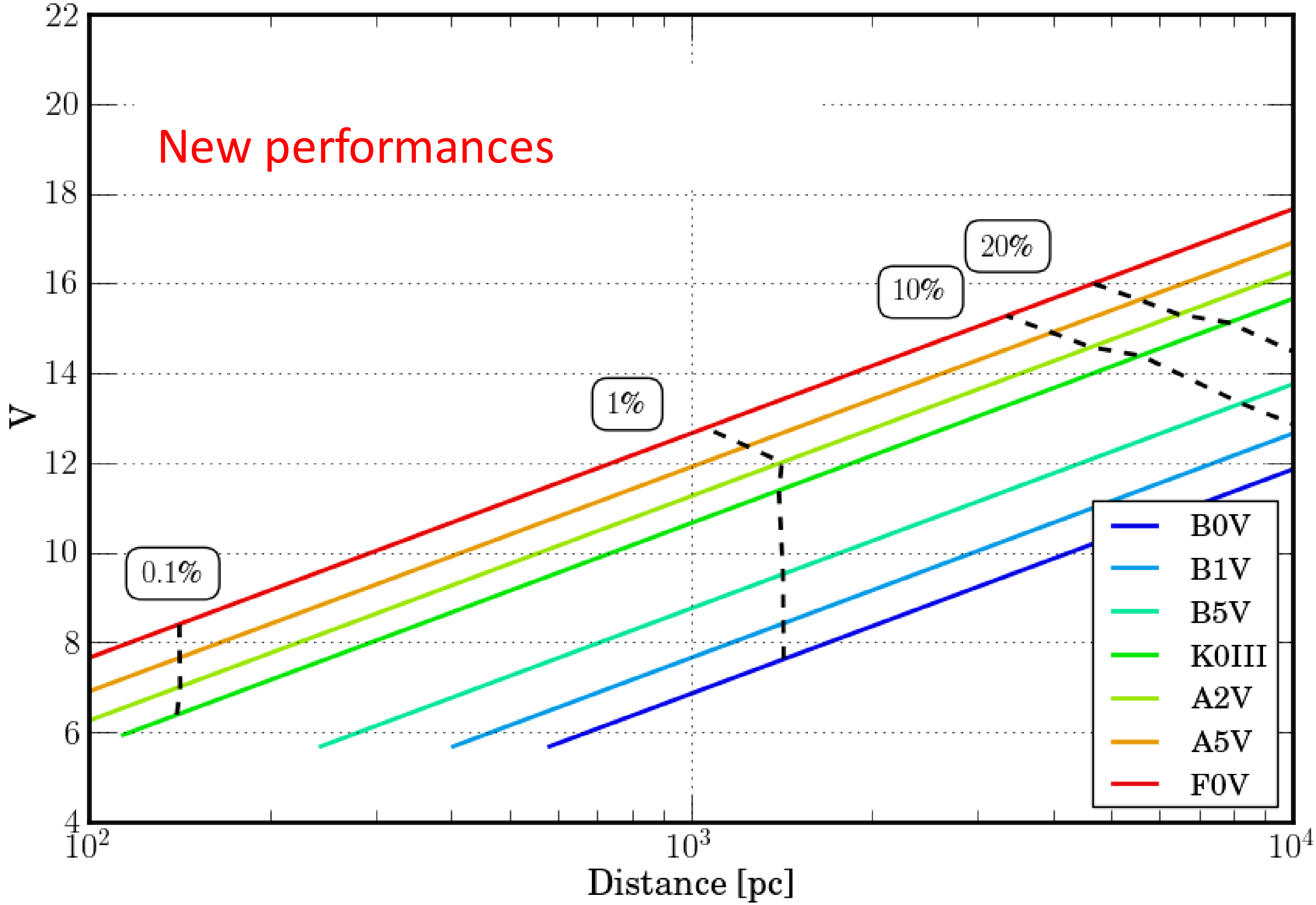
Code provided by A. Brown

Gaia parallax accuracy - no extinction – Halo



Code provided by A. Brown

Gaia parallax accuracy - no extinction – Halo



Code provided by A. Brown

Radial velocity error model

(work in progress)

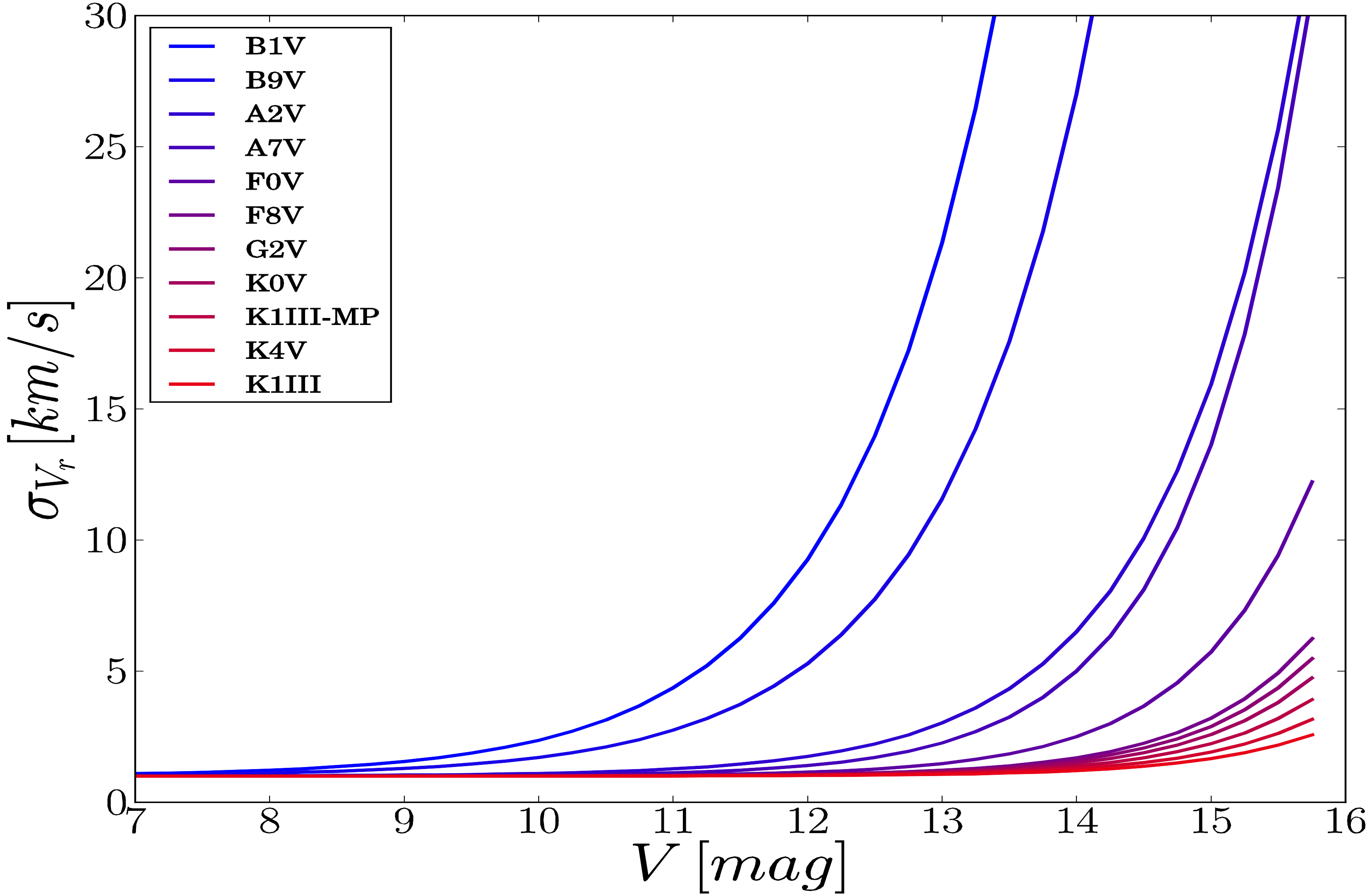
$$\sigma_{V_r} = 1 + b e^{a(V-14)}$$

Spectral type	V [mag]	Radial-velocity error [km s^{-1}]
B1V	7.5	1
	11.3	15
G2V	12.3	1
	15.2	15
K1III-MP (metal-poor)	12.8	1
	15.7	15

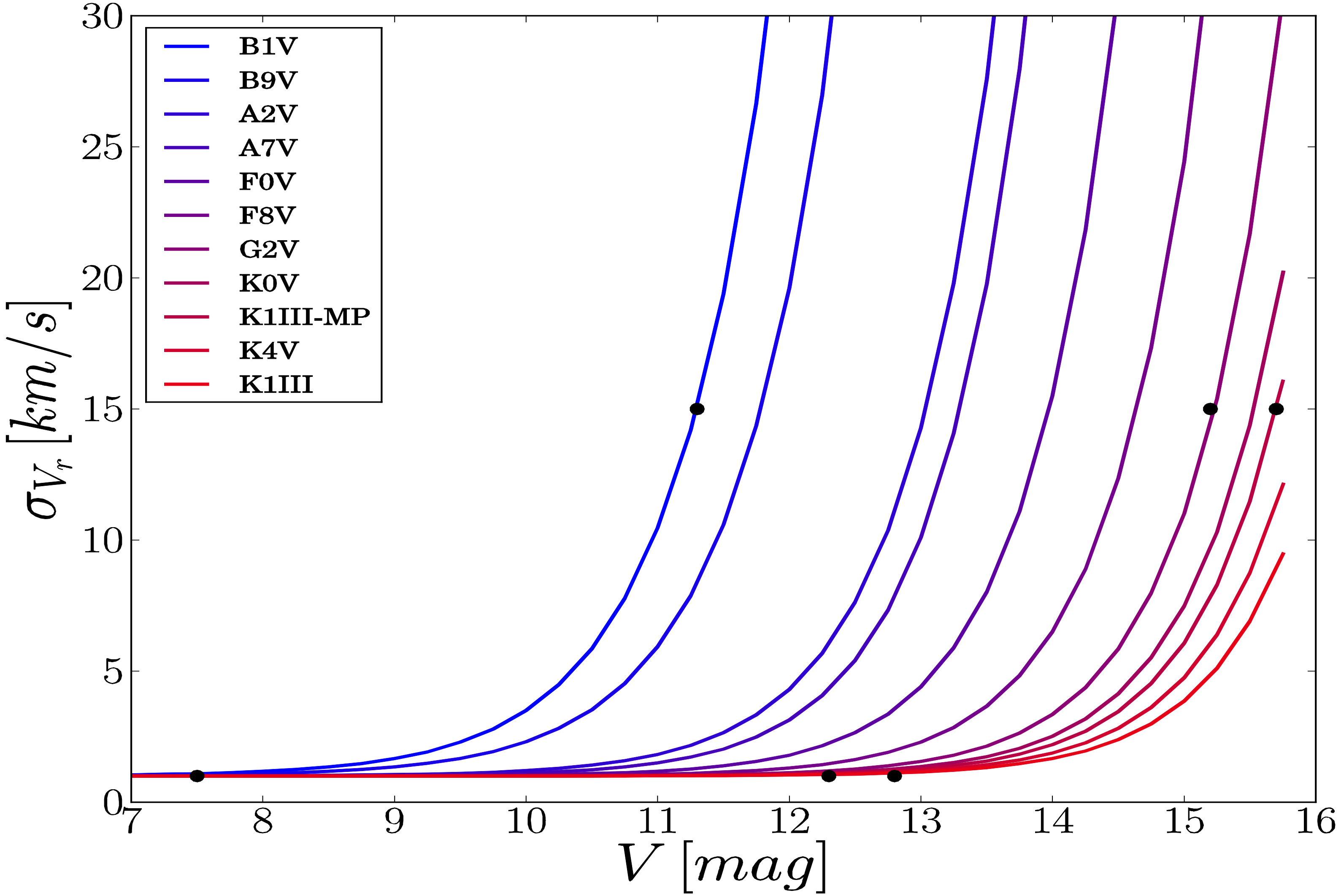
After commissioning

(V-I)c	a	b
-0.31	**1.33**	**511.35**
-0.08	1.33	266.33
0.01	1.39	53.3
0.16	1.45	38.76
0.38	1.45	14.5
0.67	1.45	5.5
0.74	**1.45**	**2.35**
0.87	1.45	1.52
0.99	**1.45**	**1.19**
1.23	1.45	0.88
1.04	1.45	0.67

Before commissioning

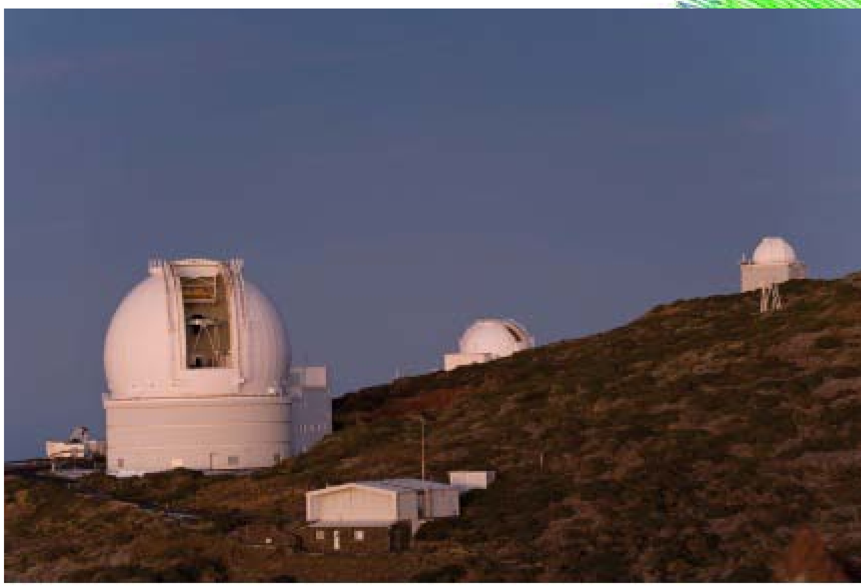


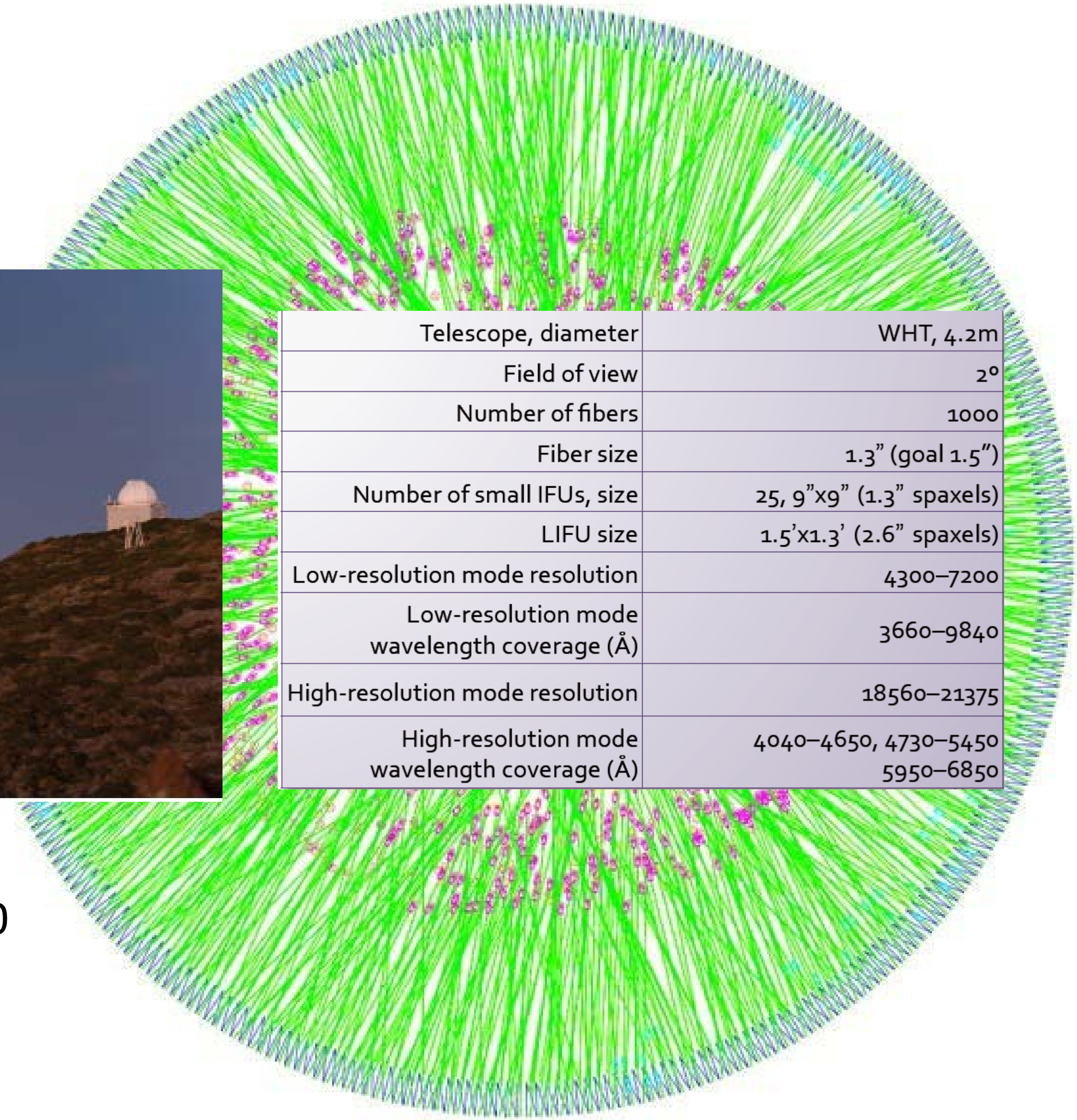
New fit



B1V
B9V
A2V
A7V
F0V
F8V
G2V
K0V
K1III-MP
K4V
K1III
$\sigma_{V_r}\ [km/s]$
$V\ [mag]$
0
5
10
15
20
25
30
7
8
9
10
11
12
13
14
15
16

An optical Multi-Object-Spectrograph (2017)
WEAVE@ WHT
Canary Island





Telescope, diameter	WHT, 4.2m
Field of view	2°
Number of fibers	1000
Fiber size	1.3” (goal 1.5”)
Number of small IFUs, size	25, 9”x9” (1.3” spaxels)
LIFU size	1.5’x1.3’ (2.6” spaxels)
Low-resolution mode resolution	4300–7200
Low-resolution mode wavelength coverage (Å)	3660–9840
High-resolution mode resolution	18560–21375
High-resolution mode wavelength coverage (Å)	4040–4650, 4730–5450 5950–6850

Radial velocities ±2 km/s V=20
Abundances V≤17

4 data sets

Available simulations:

- 2D test particles with TWA spirals
- 3D test particles with bar+response spiral arms
- Strong barred N-body simulation
- Warped disk test particle simulations

Applied:

- Gaia observational constraints
- Drimmel 3D extinction model
- Populations: A0V, RC giants