Cepheid Variables in the flared outer Disk of our Galaxy

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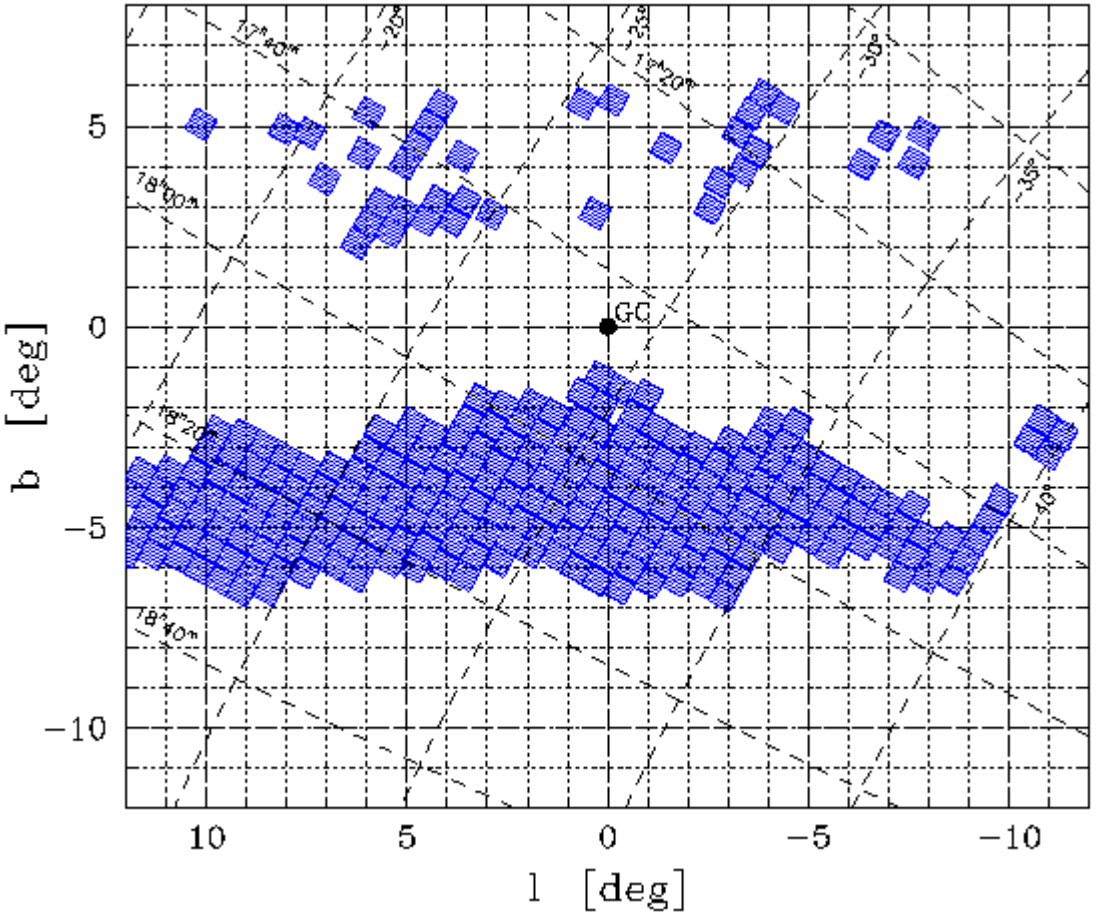

GC
b [deg]
l [deg]
5
0
−5
−10
10
5
0
−5
−10

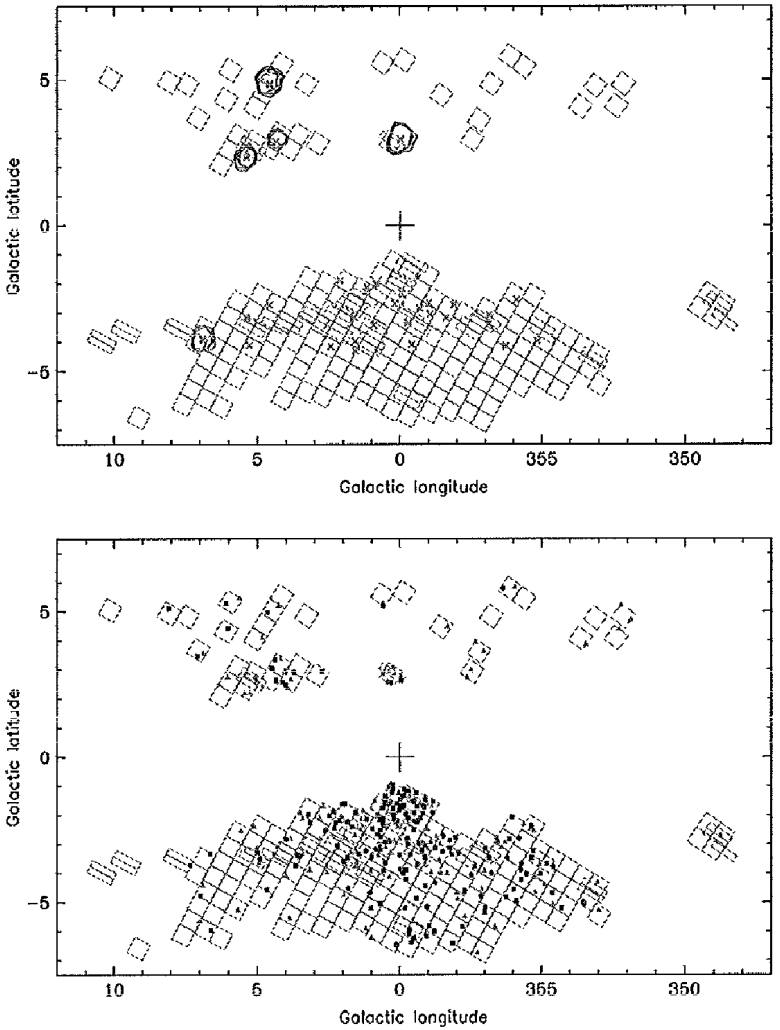


Fig. 6. Spatial distribution of classical (*upper panel*) and type II (*lower panel*) Cepheids toward the Galactic bulge. Different symbols correspond to types of stars as shown in Fig. 5. Grey contours show the OGLE-II and OGLE-III fields with the number of observations exceeding 30.

2011). Classical Cepheids are distributed almost parallel to the Galactic plane, between Galactic latitudes $-5° < b < 5°$. The OGLE-III fields closest to the Galactic center (with the largest interstellar extinction) are completely omitted by the classical Cepheids.

Distance Determination

Reddening law in Bulge direction abnormal

Current results in optical uncertain

Best in near-IR
(Nishiyama et al. 2006)

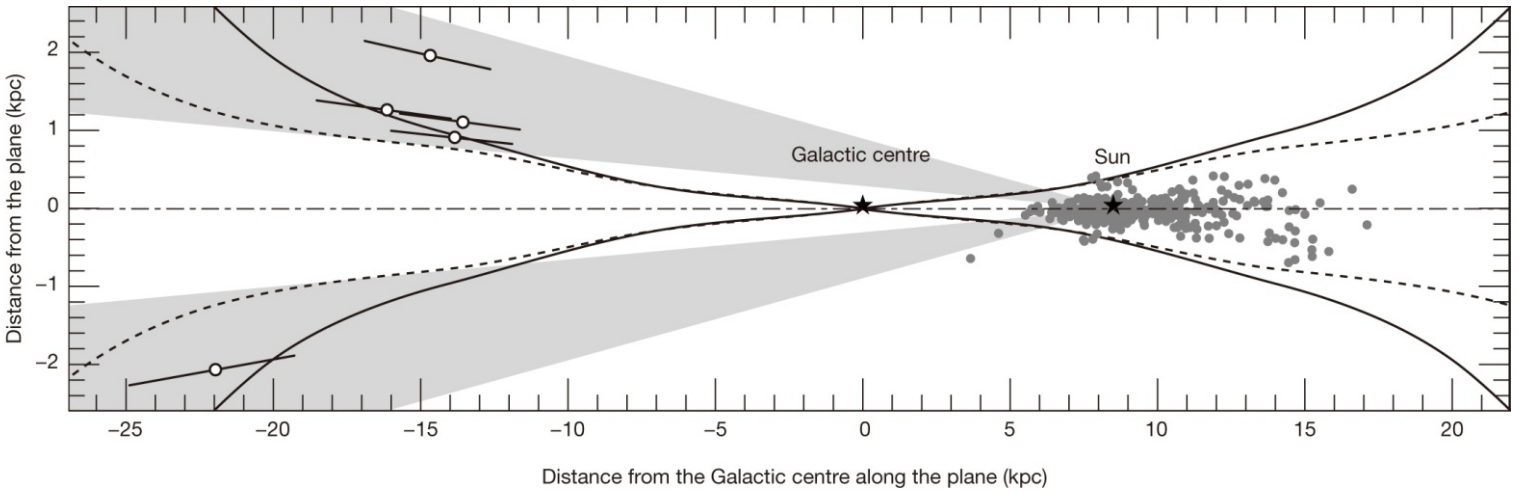
(Our results show difference from Cardelli law
Not as extreme as some have suggested)

Table 1 | Data for individual Cepheids

OGLE number	l (deg)	b (deg)	D (kpc)	z (kpc)	R (kpc)	V_R (km s^{-1})	ρ (km s^{-1})	P (day)
01	−0.03	2.94	24.7	1.3	16.2	−12	−3	2.598
02	4.57	4.85	23.2	2.0	14.7	+31	50	2.026
03	4.35	2.89	22.1	1.1	13.6	+5	24	1.236
05	5.38	2.34	22.3	0.9	13.8	+7	28	3.796
32	6.89	−3.89	30.4	−2.1	22.0	−10	15	3.736

OGLE numbers are prefixed by 'OGLE-BLG-CEP-'. l and b are the Galactic coordinates. D is the distance from the Sun (D is uncertain to less than about 2 kpc), z is the distance from the Galactic plane and R is the perpendicular distance from the axis of Galactic rotation (assuming the distance from the Sun to the Galactic centre is 8.5 kpc). V_R is the measured heliocentric radial velocity corrected for pulsation (± 15 km s^{-1}). ρ is the radial velocity after correction for solar motion, Galactic rotation and the effects of stellar pulsation. P is the pulsation period.

Schematic of the Galaxy.



MW Feast *et al. Nature* **509**, 342-344 (2014) doi:10.1038/nature13246

Numbers of Cepheids expected

Locally about 60 Cepheids above 1 kpc^2 in plane

Scale height 86pc

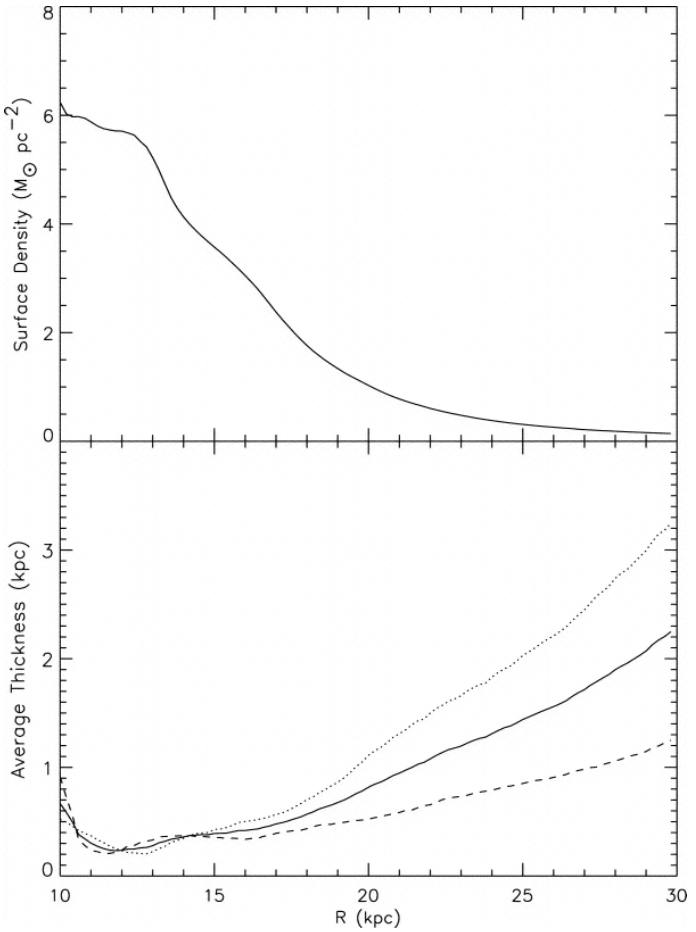
Disc scale length 3 kpc

Number expected above z=1kpc

With scale height 86pc =0.001

With scale height 577pc = 18

Levine et al 2006
Disc HI surface density and thickness versus R

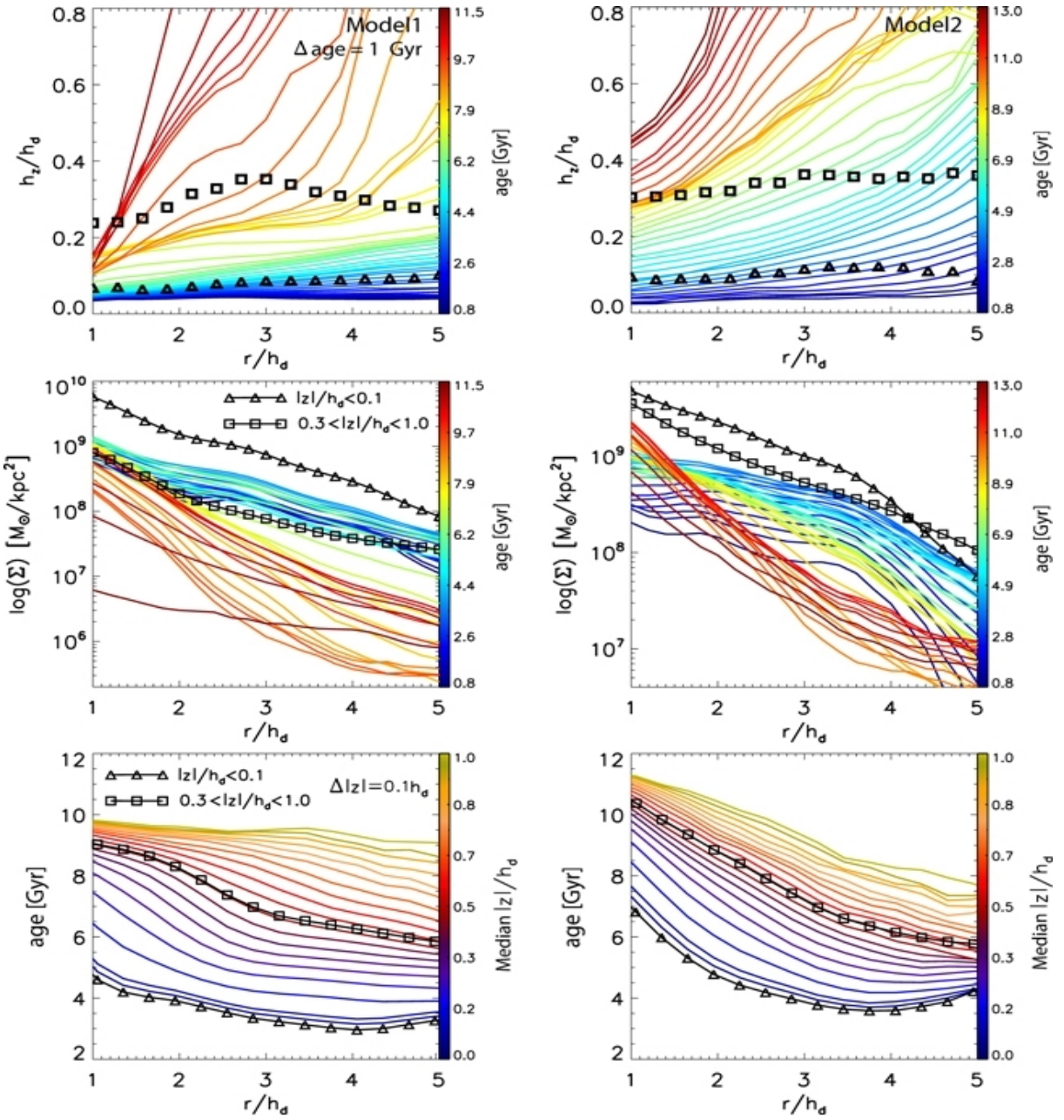


Convential Wisdom

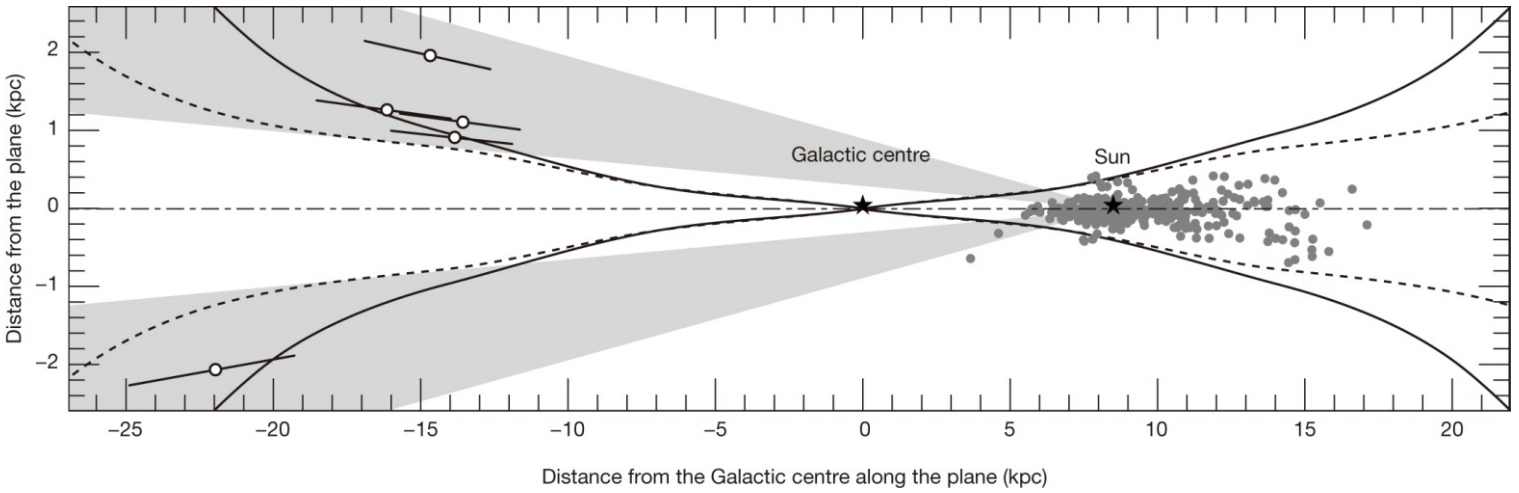
Stellar Discs
of galaxies like the Milky Way
are flat

(e.g. van der Kruit & Freeman
Ann. Rev. Ast.Astroph. 49,301,2011)

Figure 2 from On the Formation of Galactic Thick Disks
I. Minchev et al. 2015 ApJ 804 L9 doi:10.1088/2041-8205/804/1/L9



Schematic of the Galaxy.



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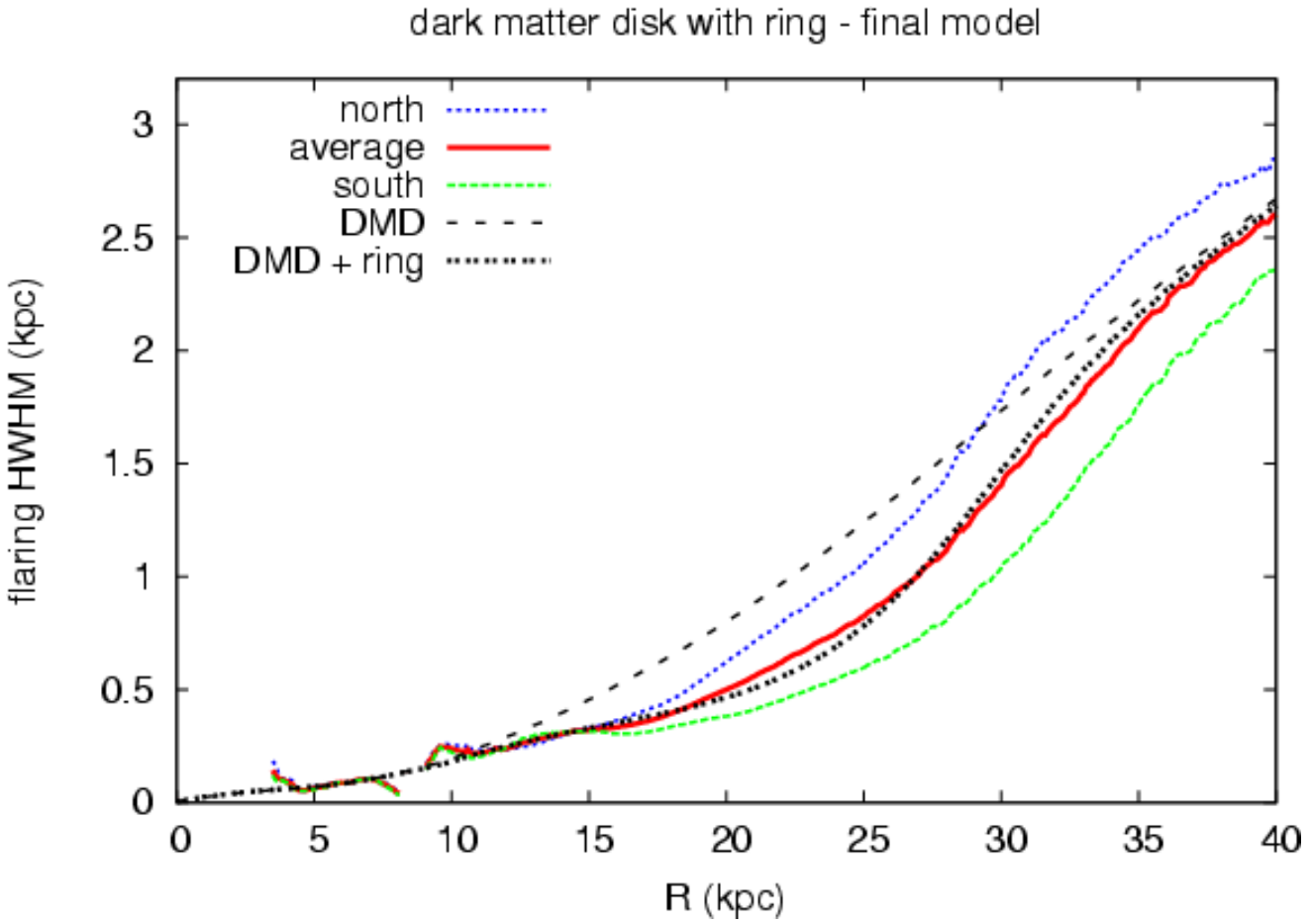
Kalberla model

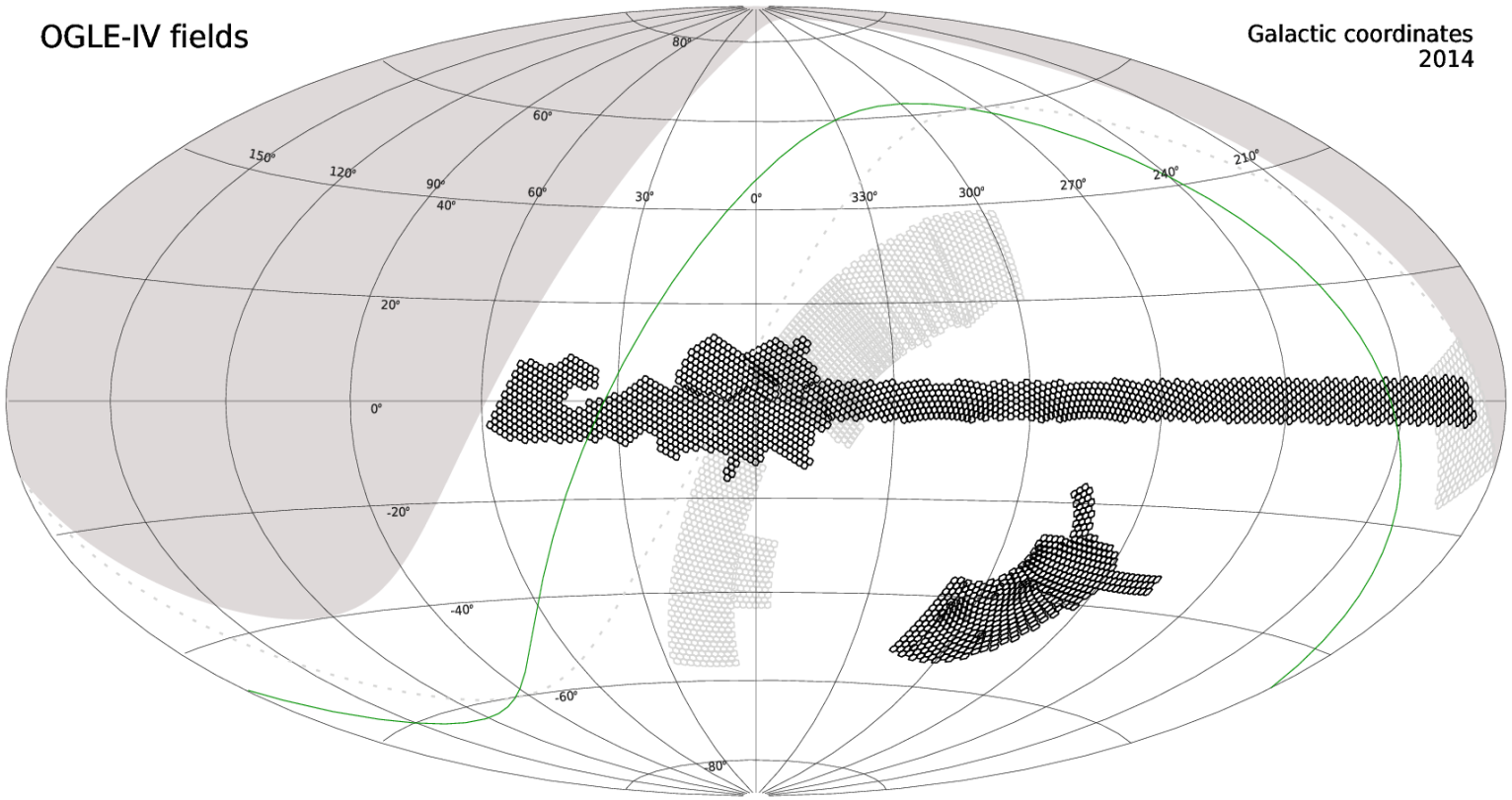
Dark Halo $1.8 \times 10^{12} M_o$

Dark Disc $1.8\text{-}2.4 \times 10^{11} M_o$

Dark Ring ($13<R<18.5$ kpc) $2.2\text{-}2.8 \times 10^{10} M_o$

Kalberla et al. 2007
HI thickeness compared with models




OGLE-IV fields
Galactic coordinates
2014
80°
60°
150°
120°
90°
60°
40°
30°
0°
330°
300°
270°
240°
210°
20°
0°
-20°
-40°
-60°
-80°

Conclusion.

If we really want to know how
spiral galaxies form and evolve,
a good way
is to start in our home galaxy
and with SALT