Development of spectroscopic instrumentation in the Spanish framework:

EMIR, WEAVE, MIRADAS, MEGARA,*HEXA, GO-IRS*

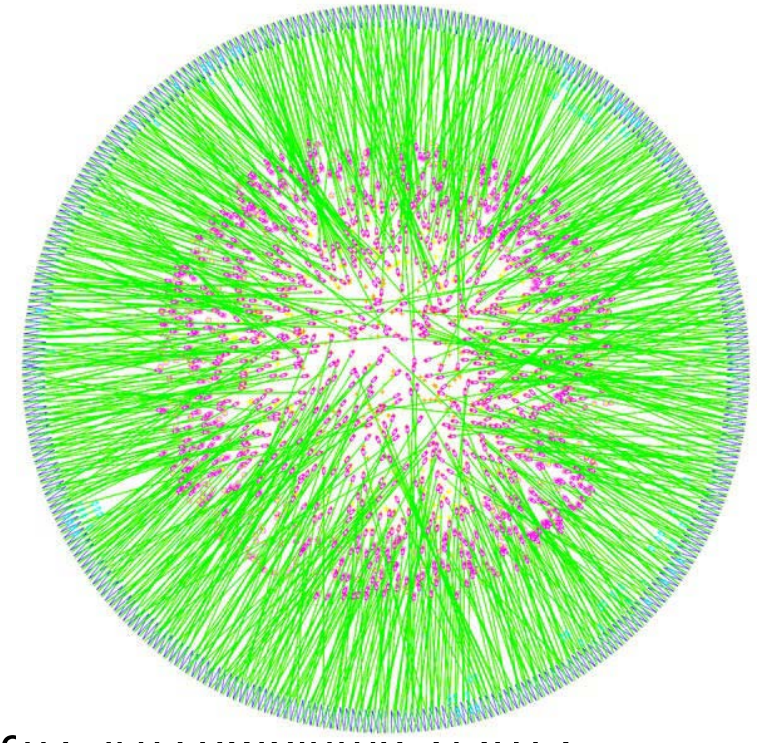
	FOV	**Targets in 5 years operation (Multiplexing)**	**RV accuracy (V limit)**	**Chemical elements**		
				[Fe/H], α/Fe	**Chemical labeling**	**Chemical tagging**
WEAVE	**2º**	>10^6 (~1000)	<2-5 km/s ~1-2 km/s	R=5k	R=20k	
HEXA	**1º (2º)**	>>10^6 (380)	< 1-2 km/s		R=25k	R=40k (TBC)
EMIR	3.5'x3.5'	>10^4 (~55)	~ 3-5 km/s	R=4k		
MEGARA	3.5'x3.5'	>10^4 (100)	~ 1-2 km/s		R=19k	
MIRADAS	3.5'x3.5'	>10^4 (20)	~ 1-2 km/s		R=20k	
GO-IRS	**15'**	10^5 (1000)	~ 1-2 km/s		R=20k	

WEAVE: optical MOS

- **For WHT**
- **FoV = 2°**
- **MOS + mIFU + LIFU**
- **R= 5k, ~1000 fibres**

  V=20 (R=5k, SNR=10, 1h)
- **R= 20k** from grating change

  V=16 (R=20k, SNR=50, 1h)
- **$\Delta\lambda$ = 0.37-1.00 µm**



Status:

- Concept Study, 01/2011, first Science Case completed 2/2012
- 03/2011 ASTRONET partners recommend North(WHT)+South(ESO) MOS
- 06/2011 UK, NL commit funding for WEAVE to PDR (expected 2013)
- 09/2011 IAC support construction of WEAVE
- 2016: Instrument First Light

WEAVE & Gaia

- Formation scenarios for Galactic stellar halo. In-situ or accreted?
  - Total mass of the Milky Way out to 200 kpc
  - The shape of the Galactic gravitational potential within 50–100 kpc
  - Lumpiness of the Galactic dark matter distribution within 20–50 kpc
- The dynamics of the Galactic disk & chemical labeling
  - Configuration space and global phase-space constraints
  - Local substructures in phase-space, resonances, and stochasticity
  - Chemo-dynamical constraints
- Galactic open clusters
  - Formation and disruption
  - Tracers of chemical evolution of the disk

HEXA: 6.5m Tel + MOS

- **6.5m telescope for CAHA**
  F#3.6 optimized for fibers /surveys
- **FoV =1º**
- **HECATE +GYES: 361 objects**
- **R = 25k** (+LR and HR)
- **$\Delta\lambda$ = 0.65-0.87 µm**
- **V~18-19 (R~25k)**
- **+ GEA Slit-less, MONSUL**

Status:

- MICINN AC 2010; System conceptual design review: 05/2012
- Schedule: 6 years after funds availability

HEXA & Gaia

- Chemical labelling (R=20k) and tagging (R=40k would be optimal) :
  - Galactic disc evolution (l=[0,200]) and outer bulge
  - Halo: merger history MW

- 2020 and beyond: HEXA can derive RV for those new UFDGs to be detected with Gaia as overdensities in the 4D space of (l,b,μl, μb) space . Excellent laboratories to test cosmological models)

EMIR: Infrared MOS

- **For GTC**
- **Multi-slits masks (~55 objects)**
- **FoV = 6'x4'**
- **R = 4k (ZJH), 3.5k (K)**
- **$\Delta\lambda$ = 0.9-2.4 µm**
- **up to K=20 (2h, S/N=5)**
- **Spectroscopy in H&K**

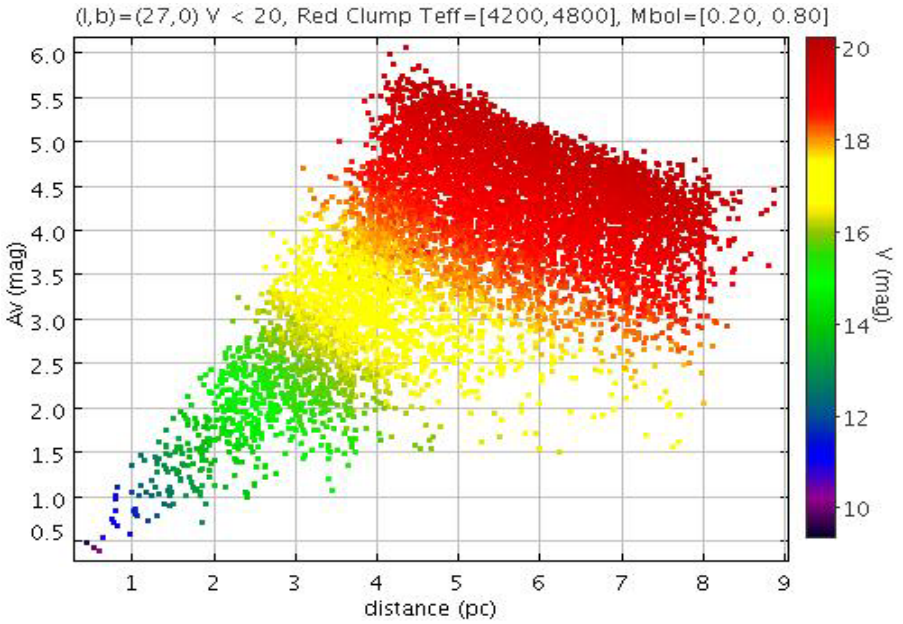
\+ **Imaging mode**

Status:

- Many parts of the instrument are already complete
- Configurable slit unit - a complex cryogenic mechanism -advanced stage
- In future months the integration of the instrument will take place
- Commissioning to GTC: 2014

EMIR & Gaia

- Inner MW (l=[0,200], GTC): true nature of the stellar components of bulge, bar, rings,...: no a priori LF
- clusters of massive stars
- Spectroscopy concentrated in the H&K: Molecular lines OH, H2O & CO and metal lines Na, Ca, Fe, etc.
- RV with ~7-10 km/s accuracy

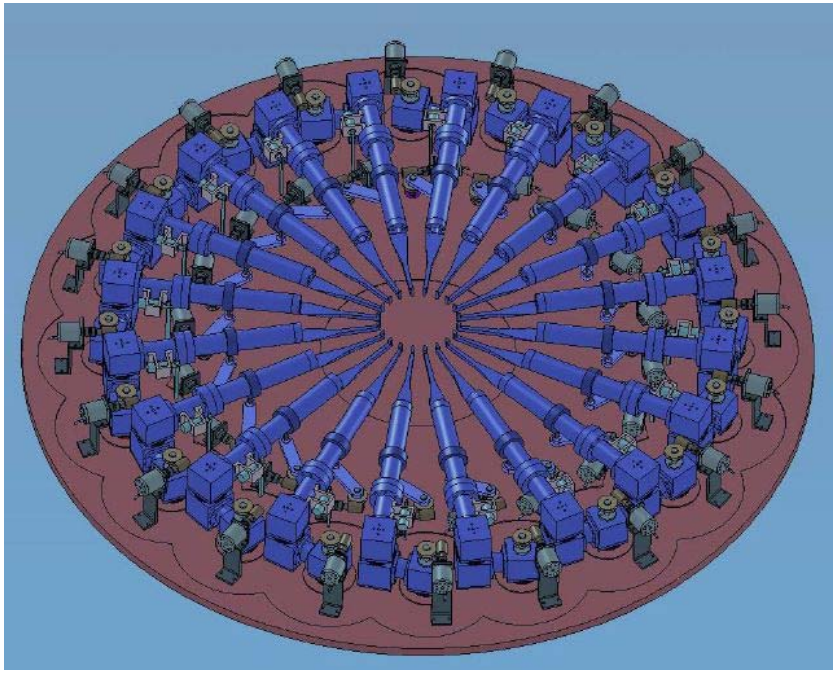


~2000 RC stars deg $^{-2}$ at (l,b)=(27,0) with V < 20 at distances r=[5,6] kpc from the Sun

Gaia at the end of the galactic bar :
$\sigma\pi$= 40 (V=18) 60 (V=19), 110 (V=20) μas
$\sigma\mu$= 20 (V=18) 30 (V=19), 60 (V=20) μas /yr

MIRADAS: near-infrared MOS

- **For GTC**
- **MOS: up to 20 probe arms (slit slicer 4”x4” each)**
- **FoV = 5’ (ϕ)**
- **R = 20k**
- **Δλ = 1-2.5 µm**
- **J=18, H=17.7, K=16.7 (SNR=10)**



Status:

- 10/3/2012: PDR
- 2013: Critical Design Review
- 2015: Instrument First Light

MIRADAS & Gaia

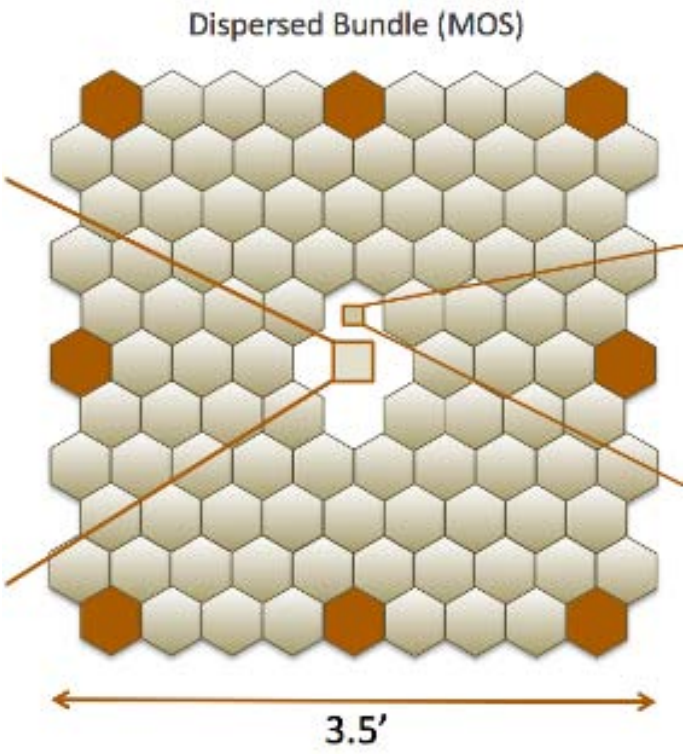
AGBs in the inner disc: detection and Gaia proper motion accuracy

	(V-G)	Limiting V mag (G=20)	Proper motion accuracy σμ (μas/yr)	Some examples: Gaia will observe these objects in well selected regions of low extinction in the inner disc up to distances of
G8III	1.5	21.5	150	8 kpc (Av=5)
K3III	1.7	21.7	150	8 kpc (Av=6)
M0III	2.2	22.1	150	8 kpc (Av=8)
M7III	4.9	24.9	150	8 kpc (Av=11)

MEGARA: optical IFU & MOS

- **For GTC**
- **MOS: (92+8) objects**
  (mini-bundle of 7 fibers, 2”.1)
- **FoV = 3.5’x3.5’**
- **R = 6k ,11k (0.36-0.97 µm)**
- **R=19k (Hα, CaT)**
- **V=24 (1h, SNR=5, R band)**

\+ **IFU (14”x12”; 10”x8”)**

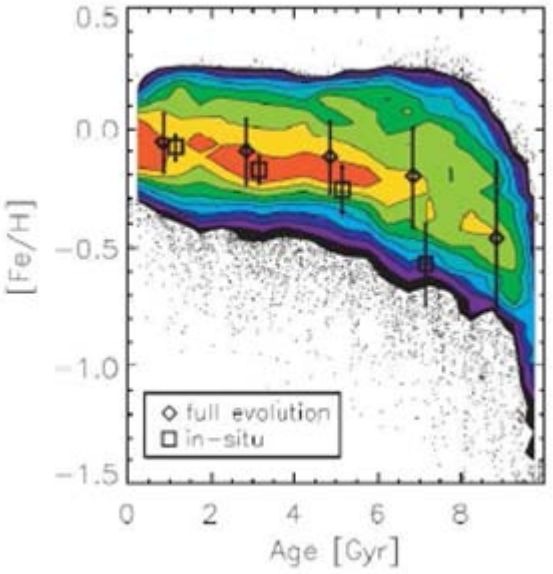


Status:

- 20/3/2012: PDR
- 2013: Critical Design Review
- 2015: Instrument First Light

MEGARA & Gaia

- Disk formation: Inside-out scenario ? Role of Stellar migration ? Churning and heating mechanisms?
- Previous assumptions of small radial mixing shall be revised
- σz of young massive RGB and blue stars very nearby face-on galaxies (GAIA?)



Age-metallicity relation for the Solar Neighbourhood (explained by radial mixing)

Gaia and M31:
Tip of RGB σμ= 20 μas /yr (V=18) , 50 km/s a 0.7Mpc
30 (V=19), 60 (V=20) μas /yr
At least an statistical treatment of tangential motion

MEGARA & Gaia

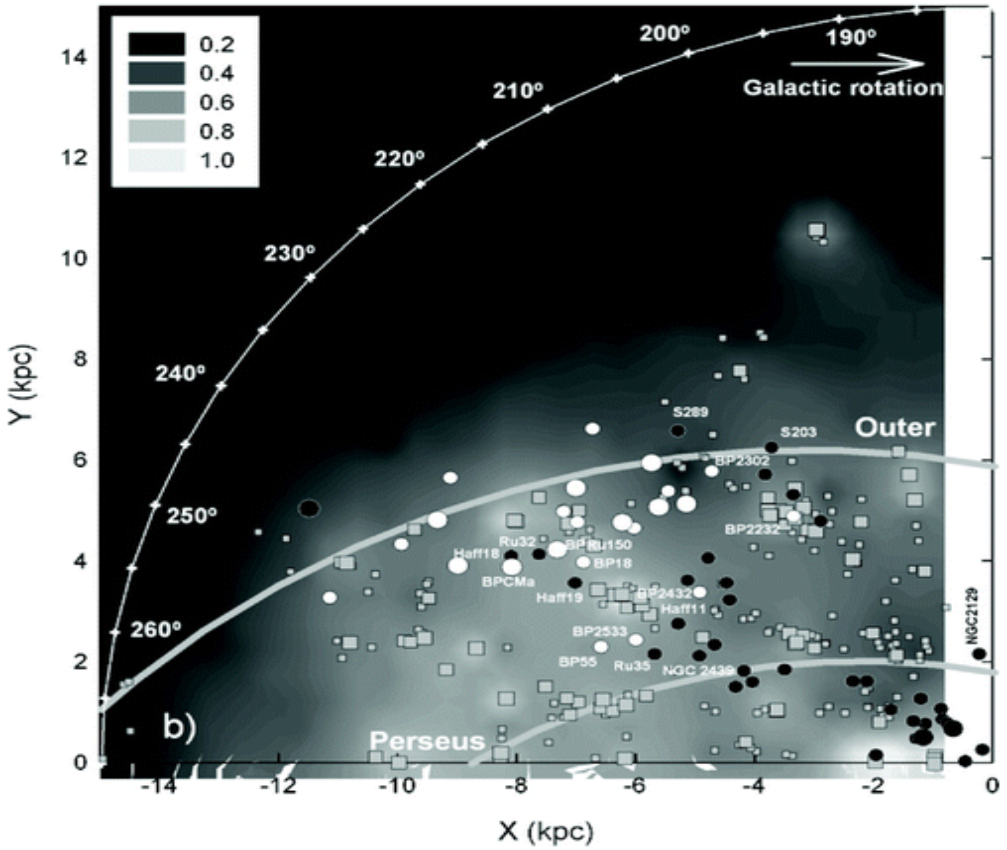
Star formation, specially in the low-mass range, down to substellar masses, and the effect of the local environment

Megara: chemical tagging (R=17000) at R=17.5

Perseus (2kpc): Gaia G=17-18, μ: 30 μas /yr & distances 10-20% error down ~ 1 Msol

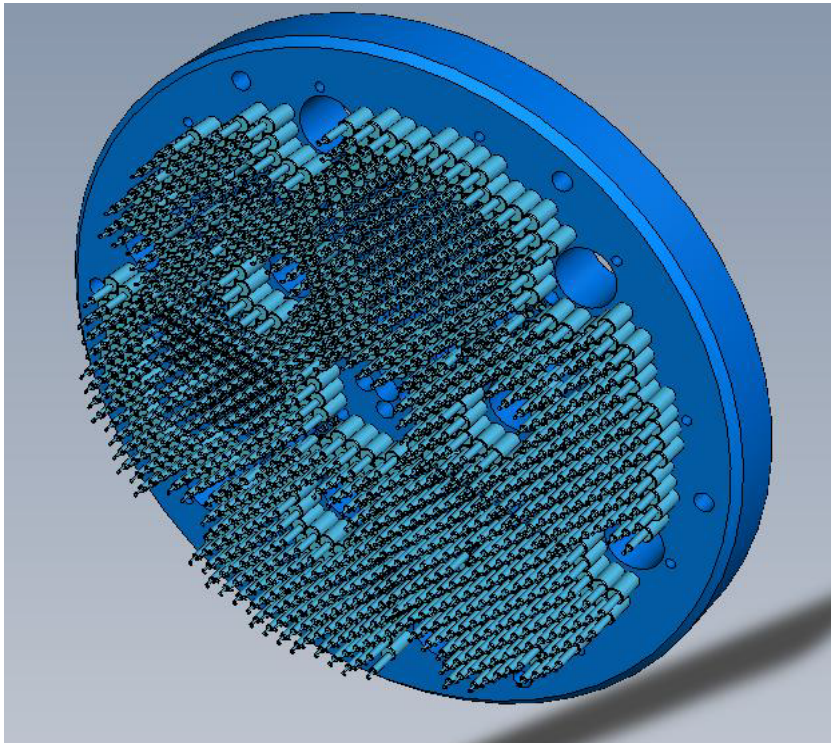
Gould Belt, Gaia G=17-18, μ: 30 μas /yr & distances 2% error Mv ~10

Gaia: multiplicity at substellar masses



GO-IRS: optical MOS & *IFU*

- **For GTC**
- **1000 MOS fibres + IFU**
- **FoV = 15 arcmin (ϕ)**
- **R = 20k, 10k, 5-2k**
- **Δλ = 0.37-1.00 µm**
  (or 0.45-1.25 µm…)



Status:

- CDR: July 2010
- Univ. Florida, China, Spain;
- Not dead yet! "…explore with [GTC] alternative options that may result in a partnership between China and Spain"

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