Characterisation of the CARMENES input catalogue (CARMENCITA)

José A. Caballero
CAB, Villafranca

What is CARMENES?

a) An instrument

b) A consortium

c) A science project

d) All of the above

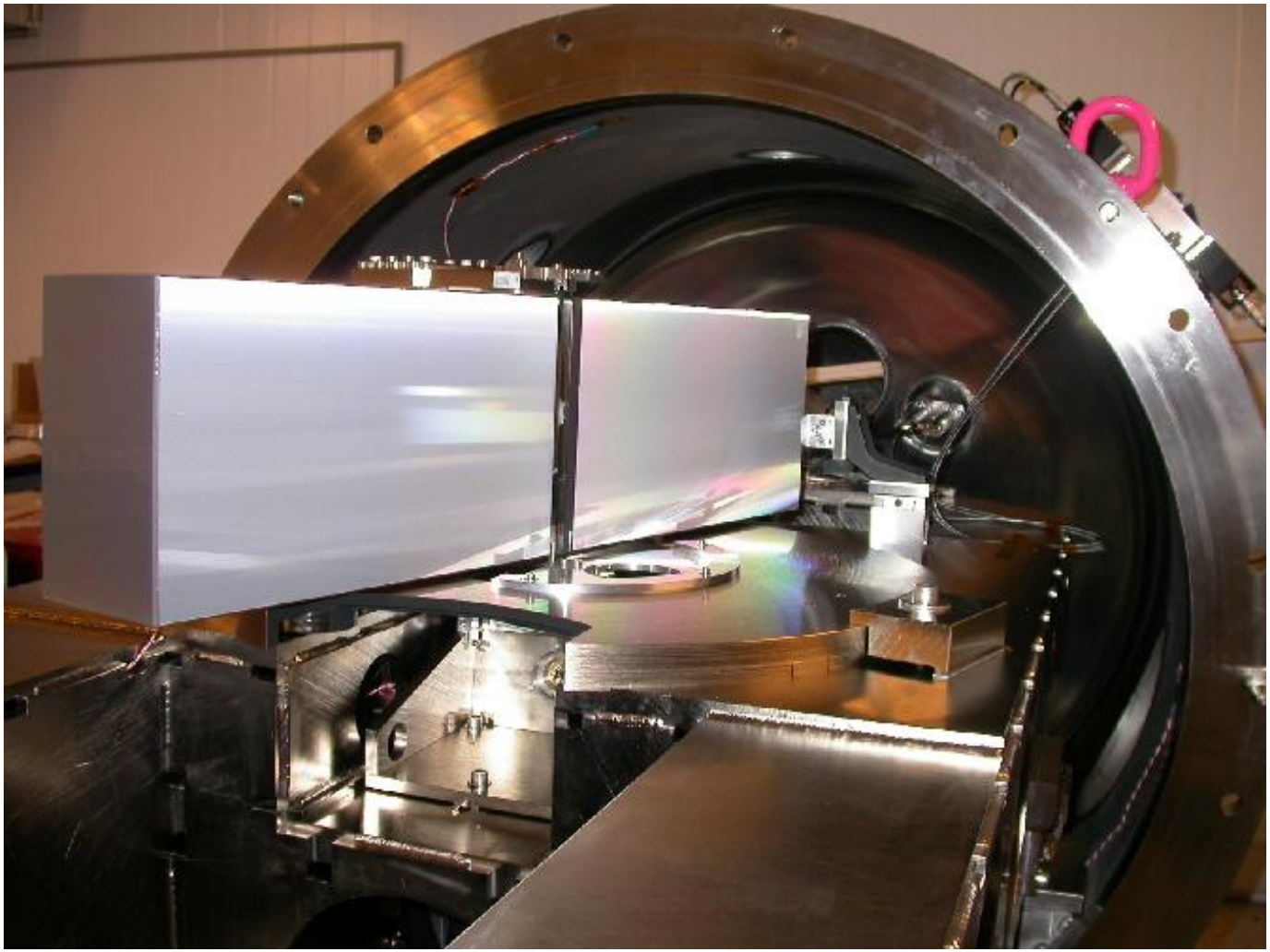
What is CARMENES?

a) An instrument (for the 3.5 m telescope on Calar Alto)
b) A consortium (of over 90 people in 11 centres in Spain and Germany)
c) A science project (to be carried out during guaranteed time – 600+ nights)
d) All of the above

What is *not* CARMENES?

HARPS (ESO, La Silla): *the exoplanet hunter*

Radial velocity; optical spectro-graph



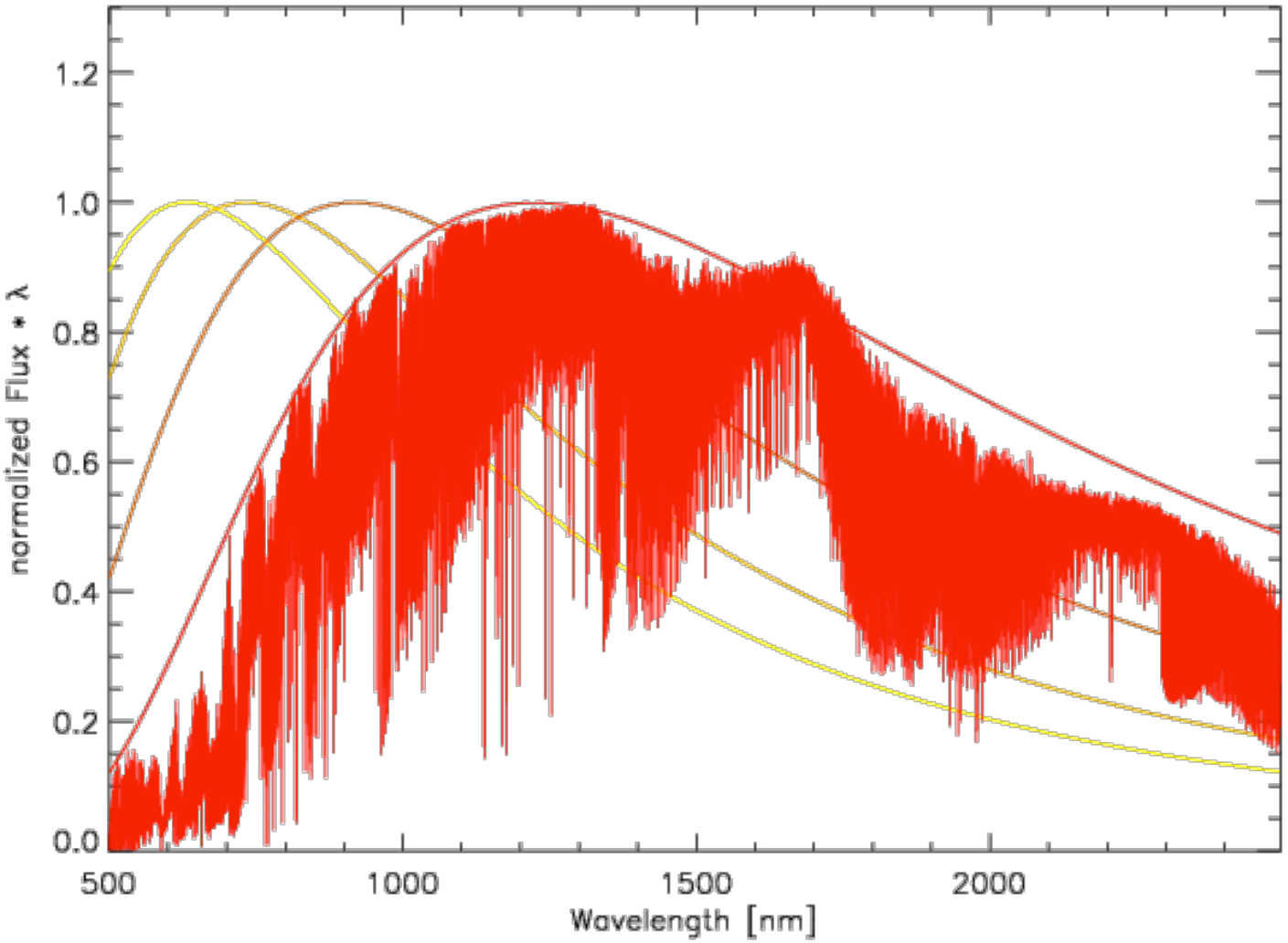
What is *not* CARMENES?

HARPS' press release last week: **Many Billions of Rocky Planets in the Habitable Zones around Red Dwarfs in the Milky Way** (Bonfils et al. 2012)

What is *not* CARMENES?

HARPS $\Delta\lambda$ = 533-691 nm

But M dwarfs are faint in the optical!



What does CARMENES mean?

Calar **A**lto high **R**esolution search for **M** dwarfs with **E**xoearths with **N**ear-infrared and optical **E**chelle **S**pectrographs

CARMENES, the instrument

Two stabilised échelle spectrographs (R=82,000):

NIR
($\Delta\lambda\approx$0.9-1.7μm)

VIS
($\Delta\lambda\approx$0.5-1.0μm)

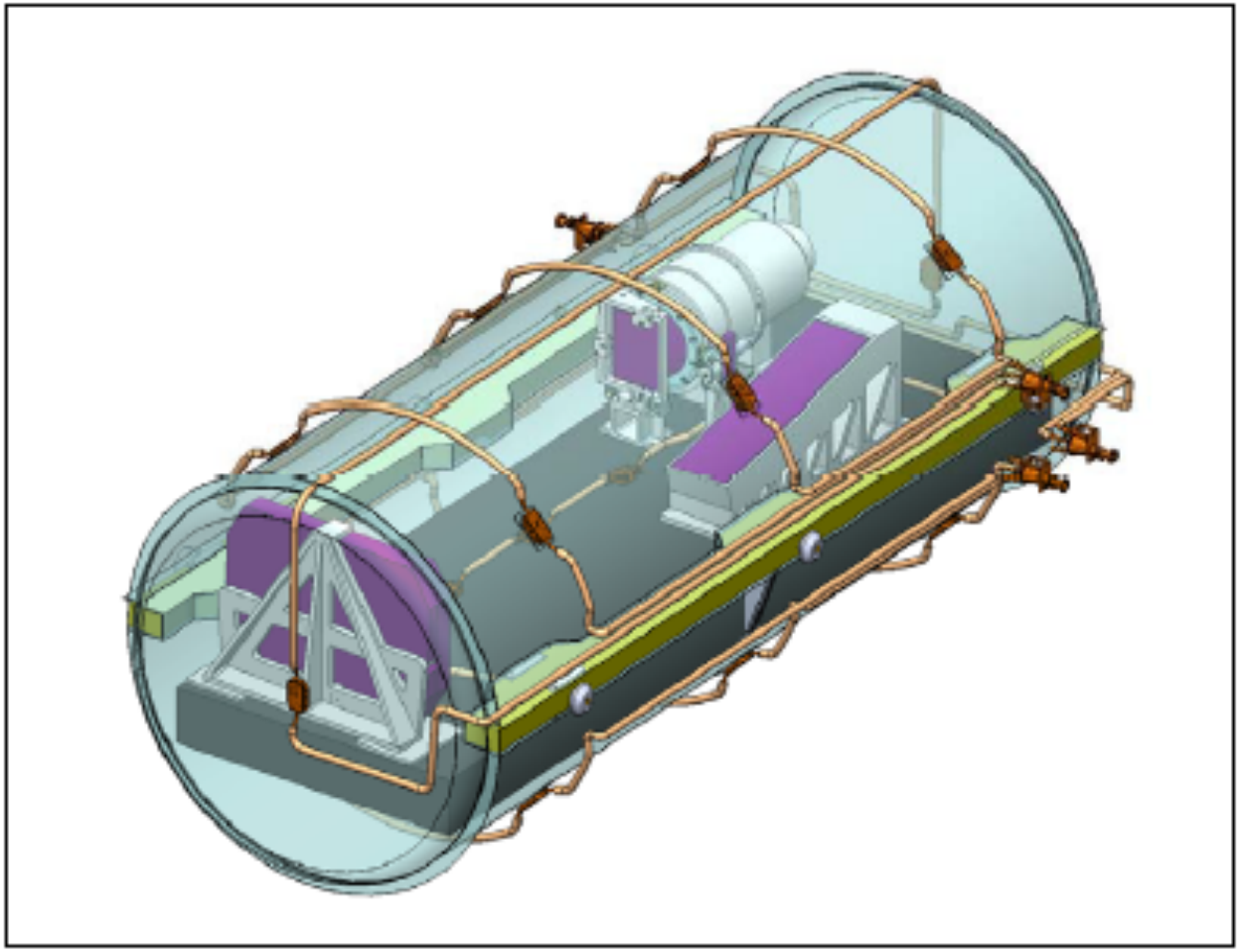


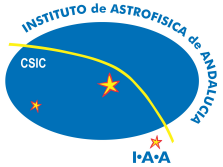
Figure 2. General view of the CARMENES NIR Optical Bench fully assembled.

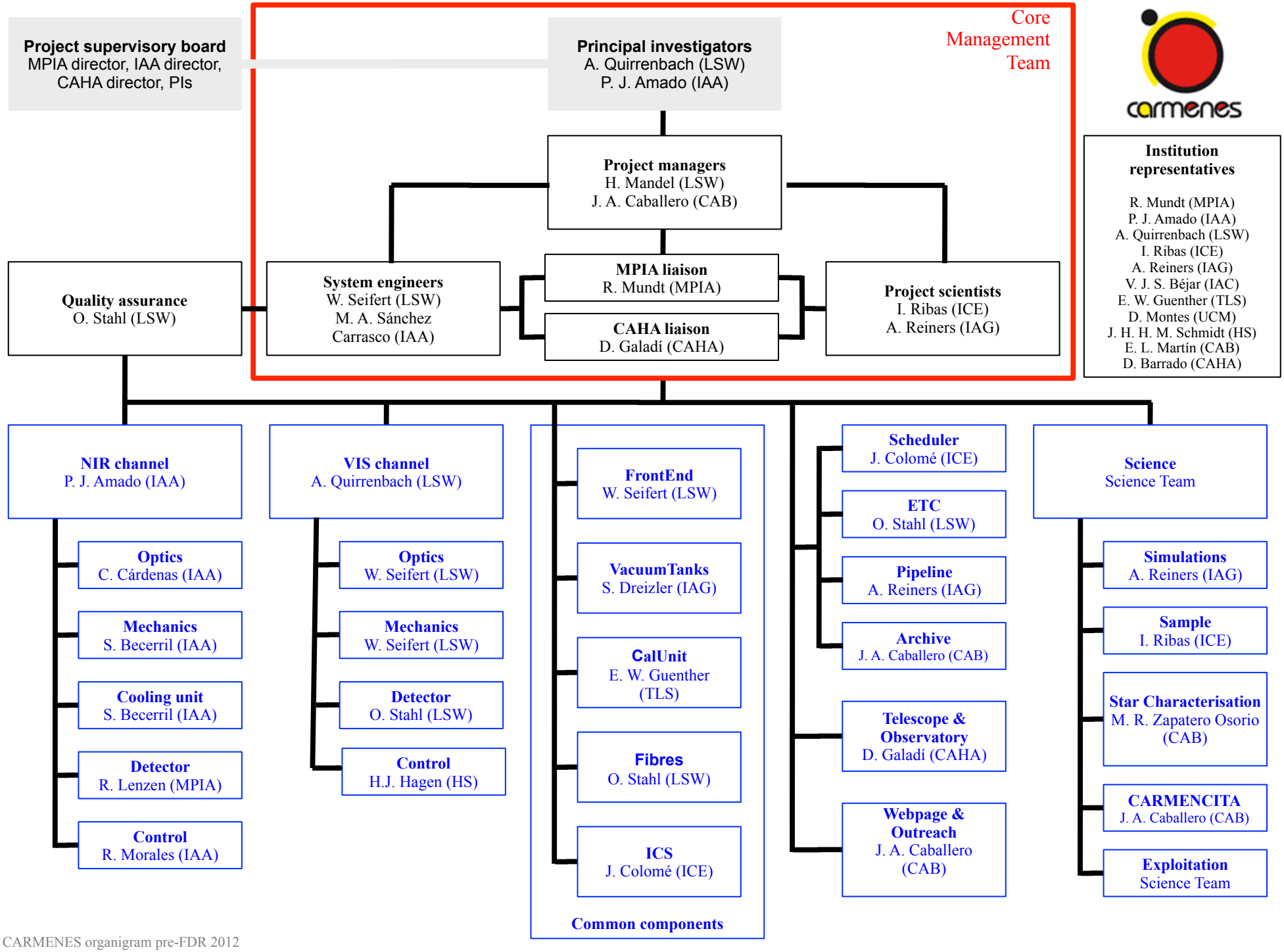
CARMENES, the consortium

MPIA (Heidelberg) • **IAA** (Granada) •
LSW (Heidelberg) • **ICE** (Barcelona) •
IAG (Göttingen) • **IAC** (Tenerife) •
TLS (Tautenburg) • **UCM** (Madrid) •
HS (Hamburg) • **CAB** (Madrid)

CAHA (50% MPG + 50% CSIC)

Germany + Spain ≥ 5.0 MEUR




Core Management Team
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P. J. Amado (IAA)
carmenes
Institution representatives
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S. Becerril (IAA)
Detector
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Control
R. Morales (IAA)
VIS channel
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Mechanics
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FrontEnd
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VacuumTanks
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O. Stahl (LSW)
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J. Colomé (ICE)
Common components
Scheduler
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ETC
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Pipeline
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Archive
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Telescope & Observatory
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Science
Science Team
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A. Reiners (IAG)
Sample
I. Ribas (ICE)
Star Characterisation
M. R. Zapatero Osorio (CAB)
CARMENCITA
J. A. Caballero (CAB)
Exploitation
Science Team

CARMENES, the project

"[...] Conducting a five-year exoplanet survey targeting ~ ***300*** *M stars with the completed instrument is an integral part of the project [...]"* (2010SPIE. 7735E..37Q)

CARMENES: Calar Alto high-Resolution search for M dwarfs with Exo-earths with Near-infrared and optical Echelle Spectrographs

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ABSTRACT

CARMENES (**C**alar **A**lto high-**R**esolution search for **M** dwarfs with **E**xo-earths with **N**ear-infrared and optical **E**chelle **S**pectrographs) is a next-generation instrument to be built for the 3.5 m telescope at the Calar Alto Observatory by a consortium of Spanish and German institutions. Conducting a five-year exoplanet survey targeting $\sim$ 300 M stars with the completed instrument is an integral part of the project. The CARMENES instrument consists of two separate spectrographs covering the wavelength range from 0.52 to 1.7 μm at a spectral resolution of $R = 85,000$, fed by fibers from the Cassegrain focus of the telescope. The spectrographs are housed in a temperature-stabilized environment in vacuum tanks, to enable a 1 m/s radial velocity precision employing a simultaneous ThAr calibration.

CARMENES, science prep.

Our aim: **to define *the best* target sample**

The best target sample?

- Comprehensive stellar characterisation and data compilation…
- **CARMENCITA: CARMEN**ES **C**ool dwarf **I**nformation and da**T**a **A**rchive
- "CARMENES input catalogue"

CARMENCITA: pseudocode

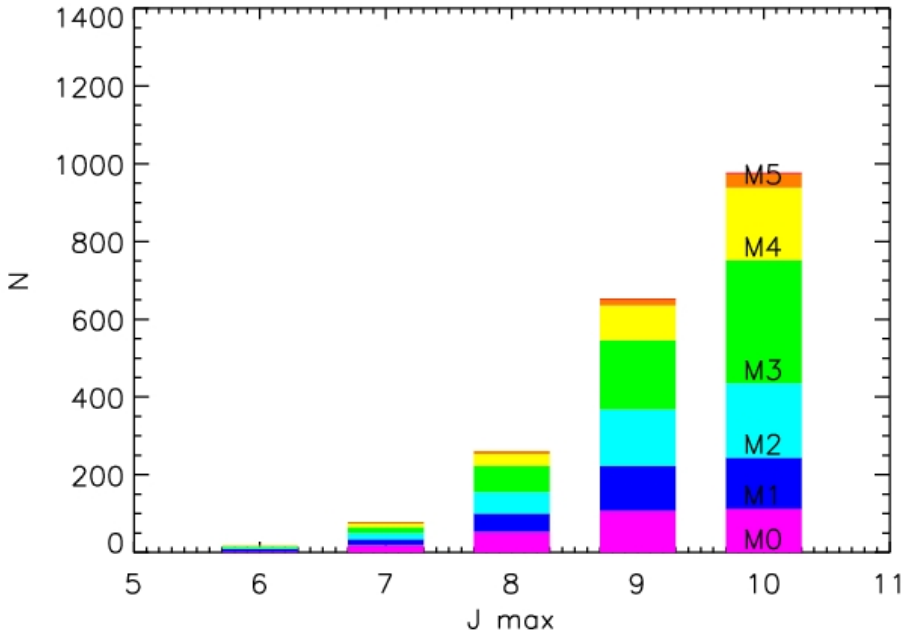
Selection criteria:

- δ > -23 deg (-13 deg)
- Single (no SB, no companion ρ < 5 arcsec)
- *The **brightest** M dwarfs with the **latest** SpTs*

SpT	α Heaven	β Limbo	ϒ Hell
≥ M6 V	<10.5	10.5-11.0	11.0-11.5
M5 V	<10.0	10.0-10.5	10.5-11.0
M4 V	<9.5	9.5-10.0	10.0-10.5
M3 V	<9.0	9.0-9.5	9.5-10.0
M2 V	<8.5	8.5-9.0	9.0-9.5
M1 V	<8.0	8.0-8.5	8.5-9.0
M0 V	<7.5	7.5-8.0	8.0-8.5

CARMENCITA: input

- First iteration: RECONS (77) and PMSU (1579)
- Second iteration: Luyten, Gliese & Jahreiss, Irwin et al., Bochanski et al., Lépine & Gaidos and further bibliographic search
- Third iteration (in parallel): VO searches (Aberasturi et al.)

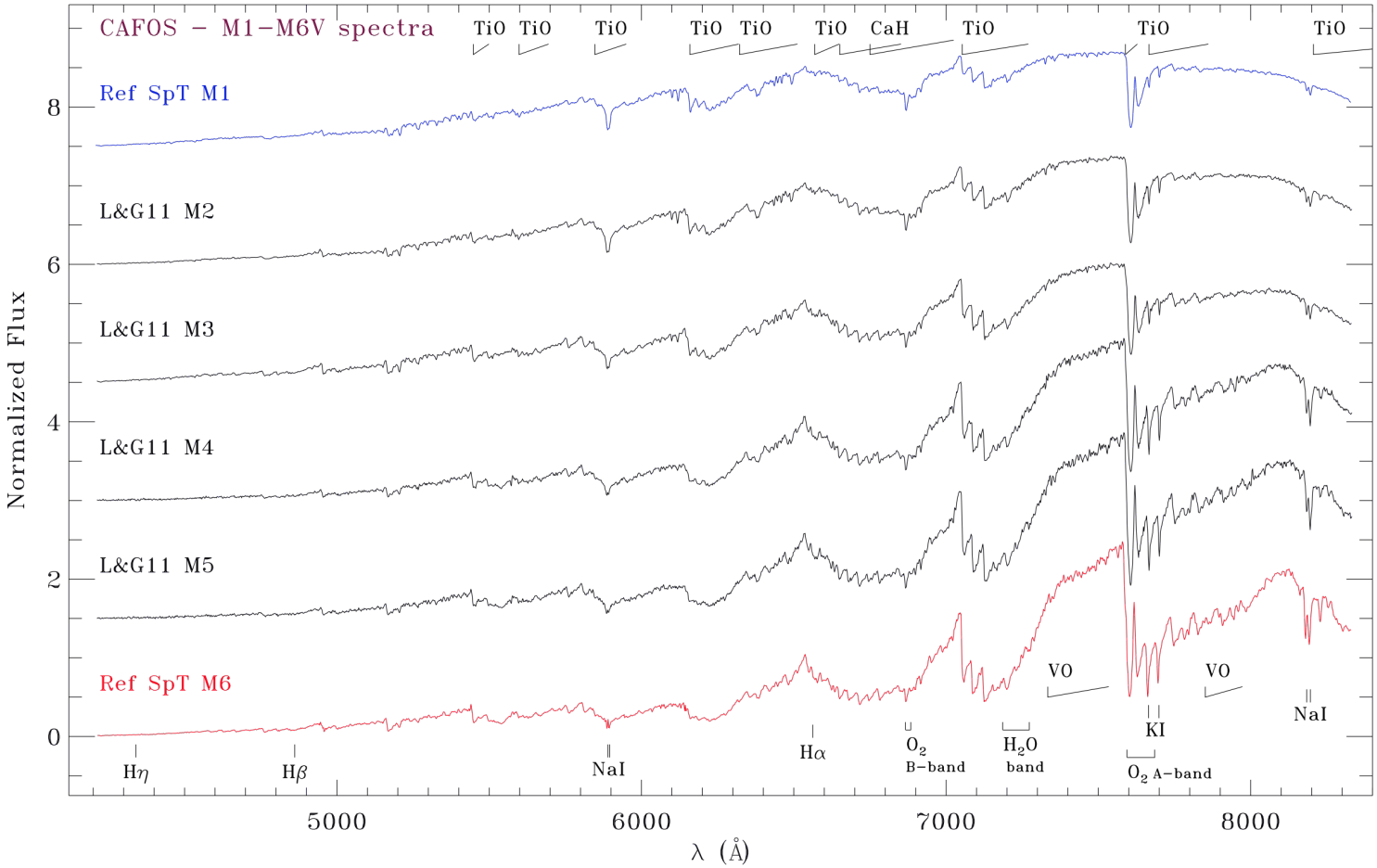


CARMENCITA: which data

Karmn | Comp | Class | Flags | Name | GJ | SpT | Ref01 | RA_J2000 | DE_J2000 | Ref02 | Ra_mag | Ref03 | IN_mag | Ref04 | J_mag | eJ_mag | H_mag | eH_mag | Ks_mag | eKs_mag | QFlag | Ref05 | WideCompanion | WideWDS | Widerho_arcsec | eWiderho_arcsec | Ref06 | WideCompanionSpT | WideCompanionJ_mag | WideCompanionFeH | Ref07 | CloseMultiplicity | CloseWDS | Closerho_arcsec | eCloserho_arcsec | Ref08 | pi_mas | epi_mas | Ref09 | d_pc | ed_pc | Ref10 | pEWHalpha_A | Ref11 | 1RXS | CRT_s-1 | eCRT_s-1 | HR1 | eHR1 | HR2 | eHR2 | Ref12 | vsini_kms-1 | evsini_kms-1 | Ref13 | Vr_kms-1 | eVr_kms-1 | Ref14 | TiO5 | CaH2 | Ref15 | OtherActivityIndicators | Flare | Ref16 | P_d | Ref17 | muRA_masa-1 | emuRA_masa-1 | muDE_masa-1 | emuDE_masa-1 | Ref18 | MV_mag | Ref19 | U_kms-1 | eU_kms-1 | V_kms-1 | eV_kms-1 | W_kms-1 | eW_kms-1 | Ref20 | RV | Planet | Ref21 | Origin | Notes

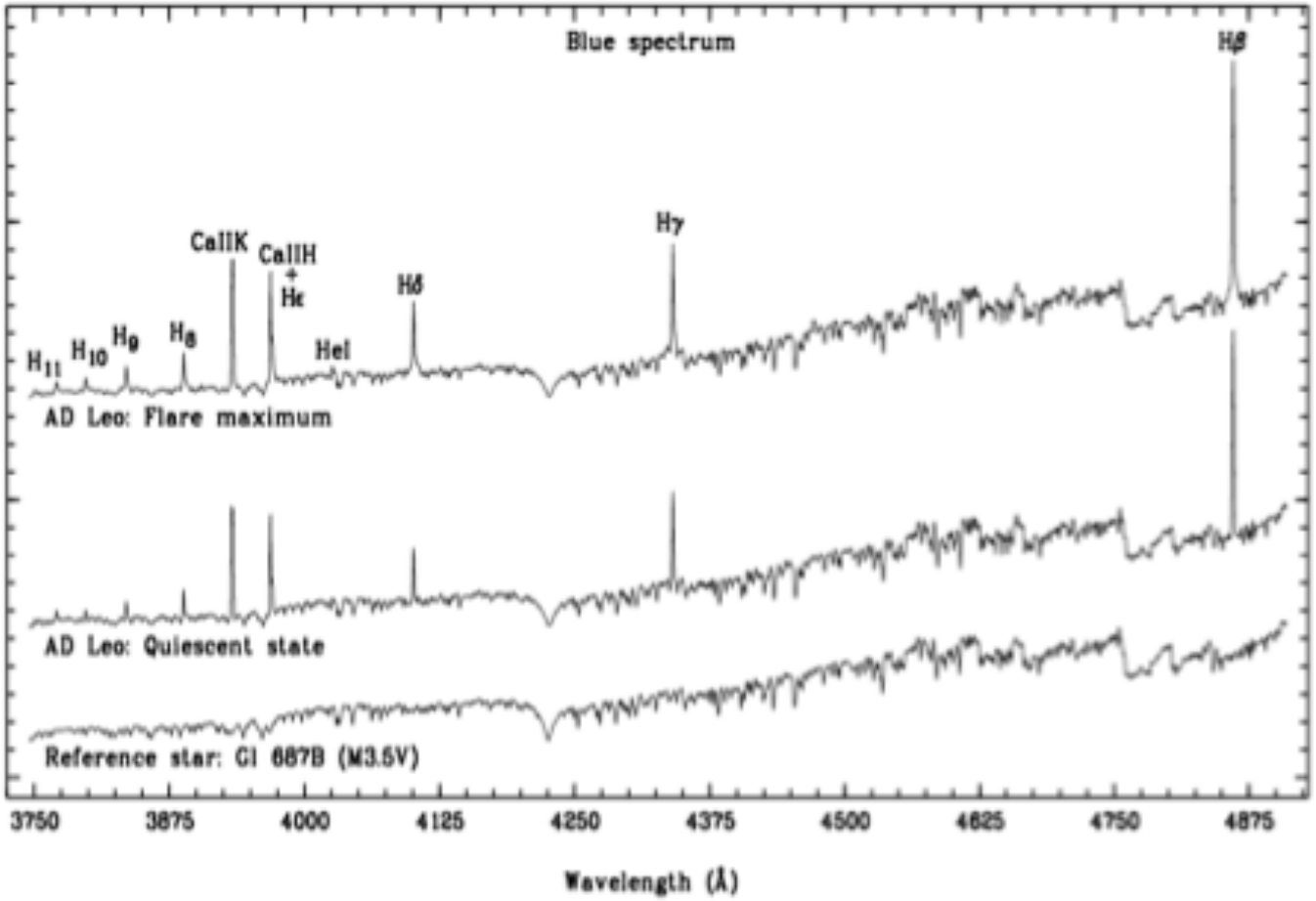
CARMENCITA: preparation

- **Low-resolution spectroscopy** (CAFOS): SpT, pEW(Hα)



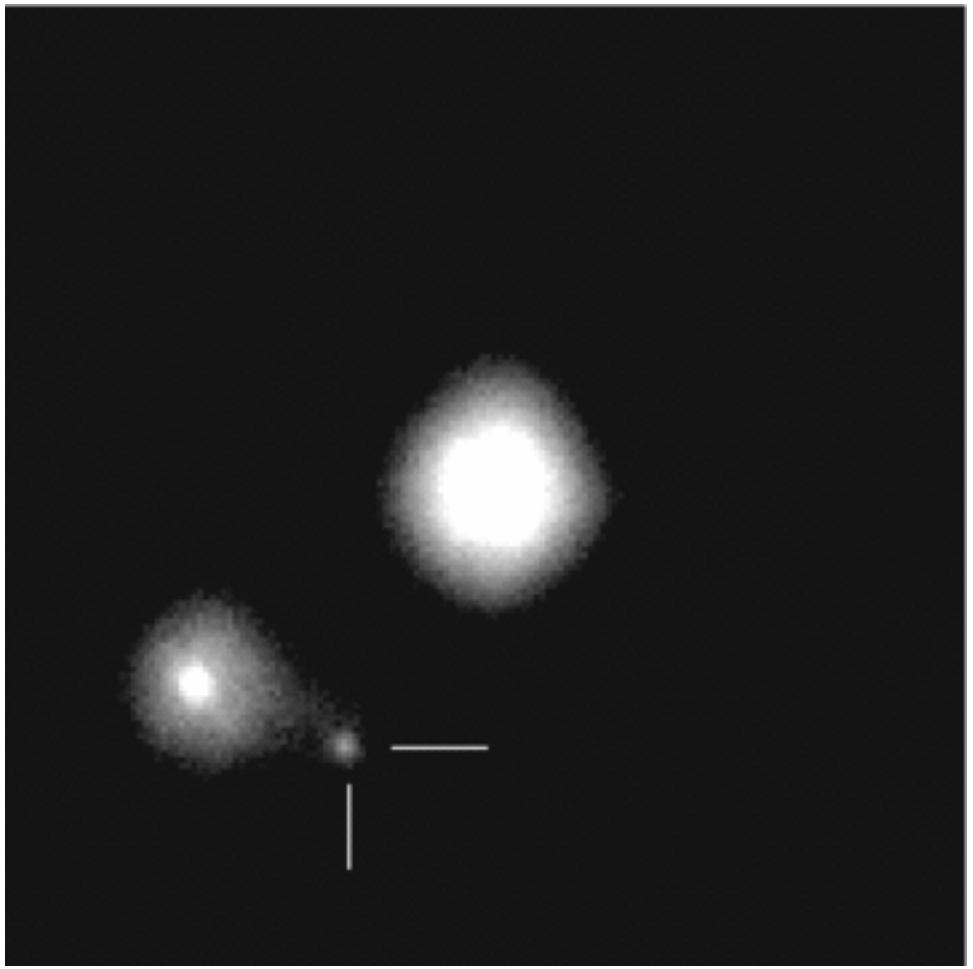
CARMENCITA: preparation

- **High-resolution spectroscopy** (CAFÉ, FEROS): V_r, *vsini*, other activity indicators, spectroscopic multiplicity (N >1)



CARMENCITA: preparation

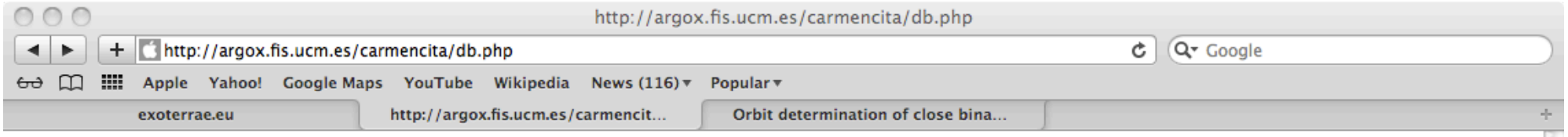
- **High-resolution imaging**: close resolved multiplicity
- Compilation from the literature
- Recent data (Hormuth et al., Pérez-Garrido et al.)
- Our own observations with FastCam (and AstraLux)



Rica et al. (2012, MNRAS)

CARMENCITA: output

- *The most comprehensive M dwarf catalogue* (by far…)
- Full dataset provided in an easy way to the CARMENES Science Working Group
- Next to everybody in the consortium
- Eventually public (CARMENES **legacy**)



Carmencita

carmenes

- Public
- Private
- Carmencita
- Database
- Search
- Referees

CARMENCITA

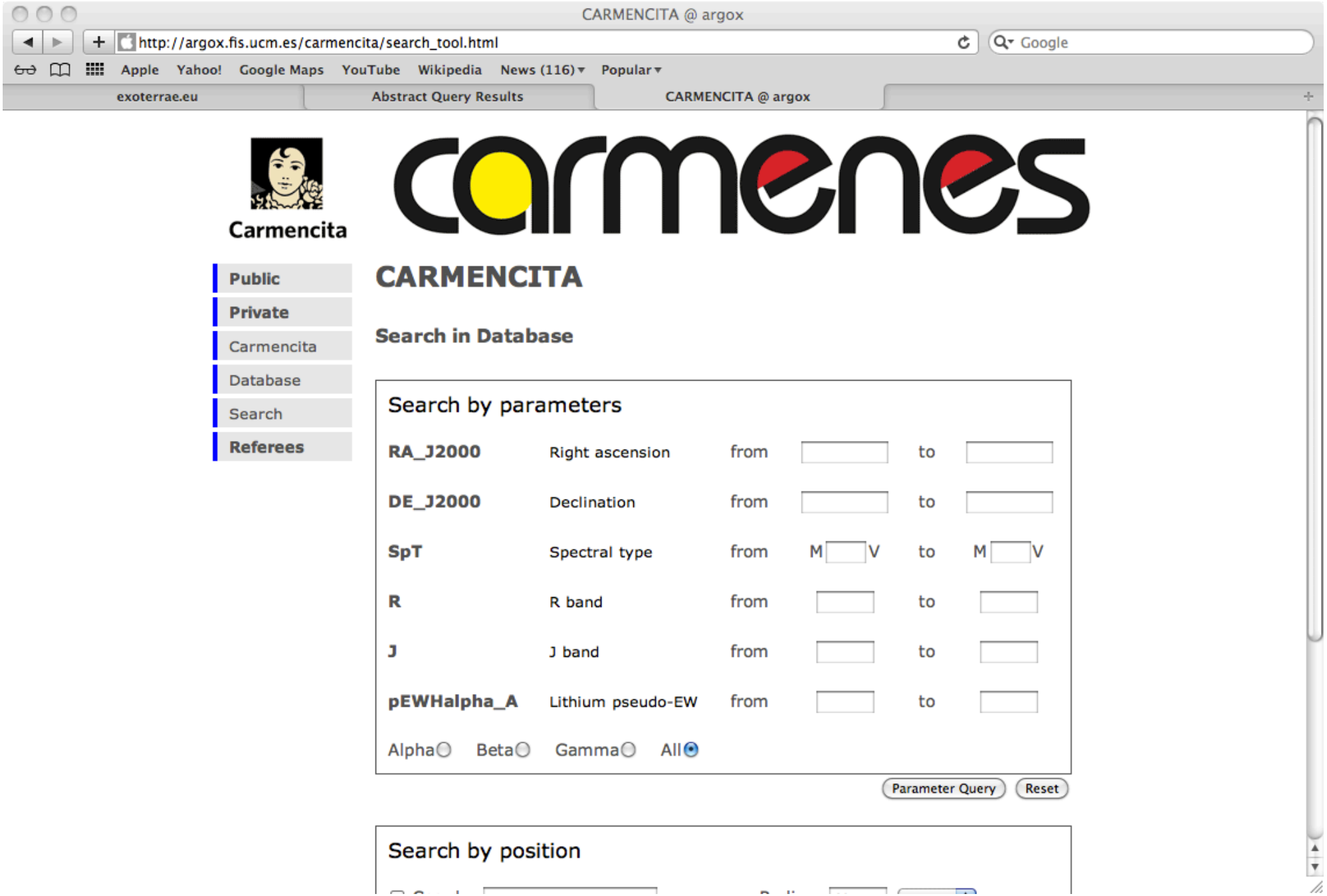
Database

Formerly Alpha, Beta and Gamma

More data • Ascii file • XML file (for Aladin)

Id	Karmn	Class	Name	GJ	SpT	RA_J2000	DE_J2000	J_mag	pEWHalpha_A
1	J00067-075	Alpha	GJ 1002	1002	M5.5 V	00:06:43.26	-07:32:14.7	8.323	0.000
2	J00079+080	Beta	LHS 1022	3007	M3.0 V	00:07:59.09	+08:00:19.1	9.392	0.000
3	J00088+208	Alpha	LP 404-33	3010	M4.5 V	00:08:53.92	+20:50:25.2	8.870	4.980
4	J00132+693	Gamma	GJ 11 AB	11AB	M3.0 V+M:	00:13:15.79	+69:19:37.2	8.556	0.000
5	J00136+806	Alpha	G 242-048 A	3015A	M1.5 V	00:13:38.81	+80:39:56.9	7.756	0.000
6	J00137+806	Gamma	G 242-048 B	3015B	M5.0 V	00:13:43.06	+80:39:49.4	10.936	3.200

995	J23541+516	Gamma	G 217-023	4373	M3.5 V	23:54:10.49	+51:41:09.9	9.574	0.000
996	J23544+081	Beta	G 030-028	4374	M3.0 V	23:54:26.80	+08:09:43.5	9.243	0.000
997	J23554-039	Gamma	LHS 4046	4376	M3.5 V	23:55:25.92	-03:59:00.0	9.866	0.000
998	J23556-061	Alpha	GJ 912	912	M2.5 V	23:55:39.81	-06:08:32.8	7.600	0.000
999	J23573-129N	Gamma	LP 704-14 Bab	4379Bab	M4.0 V+	23:57:19.35	-12:58:40.7	9.128	4.390
1000	J23573-129S	Alpha	LP 704-15 A	4378A	M3.0 V	23:57:20.57	-12:58:48.7	8.636	0.000
1001	J23577+233	Alpha	GJ 1292	1292	M3.5 V	23:57:44.10	+23:18:17.0	7.800	0.000
1002	J23577+197	Beta	LHS 5411	4380	M3.5 V	23:57:45.17	+19:46:11.2	9.035	0.000
1003	J23578+386	Gamma	LP 291-34	4381	M3.0 V	23:57:49.90	+38:37:46.9	8.691	3.760
1004	J23585+076	Alpha	Wolf 1051	4383	M3.0 V	23:58:32.64	+07:39:30.4	7.907	0.000
1005	J23598+477	Gamma	LHS 4057	4385	M5.0 V	23:59:49.41	+47:45:44.8	10.866	0.000


CARMENCITA @ argox
http://argox.fis.ucm.es/carmencita/search_tool.html
Google
Apple
Yahoo!
Google Maps
YouTube
Wikipedia
News (116)
Popular
exoterrae.eu
Abstract Query Results
CARMENCITA @ argox
Carmencita
carmenes
Public
Private
Carmencita
Database
Search
Referees
CARMENCITA
Search in Database
Search by parameters
RA_J2000 Right ascension from to
DE_J2000 Declination from to
SpT Spectral type from M V to M V
R R band from to
J J band from to
pEWHalpha_A Lithium pseudo-EW from to
Alpha Beta Gamma All
Parameter Query
Reset
Search by position

CARMENCITA will link to…

- customised finding charts
- ascii astro-photometric file of close stars for A&G-ing
- all preliminary science data (lo-res, mid-res spectroscopy, hi-res imaging – reduced)
- Simbad, VizieR, WDS, any other relevant catalogue
- and the CARMENES spectra archive! (López del Fresno et al.)

But in the meantime…

- A lot of work to do!
- Proposals, observations, reduction, data mining, analysis, give format, coordination, and put everything together…

Summary

- **CARMENCITA: CARMEN**ES **C**ool dwarf **I**nformation and da**T**a **A**rchive
- Stellar characterisation and data compilation: huge amount of information, useful for many scientists
- Necessary to define *the best* target sample (300)
- Eventually public (CARMENES legacy)


carmenes

Schedule

- **Pre-selection**: January 2009
- **CDR**: October 2009
- **pCDR**: July 2010
- **Green light**: November 2010
- **PDR**: July 2011
- **FDR**: Nov 2012 (optics-FDR Apr 2012)
- **AIV**: 2013
- **First light, commissioning**: early 2014
- **Start survey**: mid 2014

Advantages

- Simultaneous near-infrared and visible observations
- Both high resolution and wide spectral coverage
- Dedication to stable high-precision radial-velocity survey of exoplanets around M dwarfs
- Long guaranteed time for the completion of the project
- Avoid the complications of cryogenics
- Early first light