

Building complete censuses and studying disk evolution to understand how brown dwarfs form

A. Bayo

ESO-Chile Fellow

—
D. Barrado, N. Huélamo, H. Bouy,
C. Rodrigo and SVO team,
M. Morales-Calderón, J.R. Stauffer
B. Stelzer
C. Melo
—

ESAC

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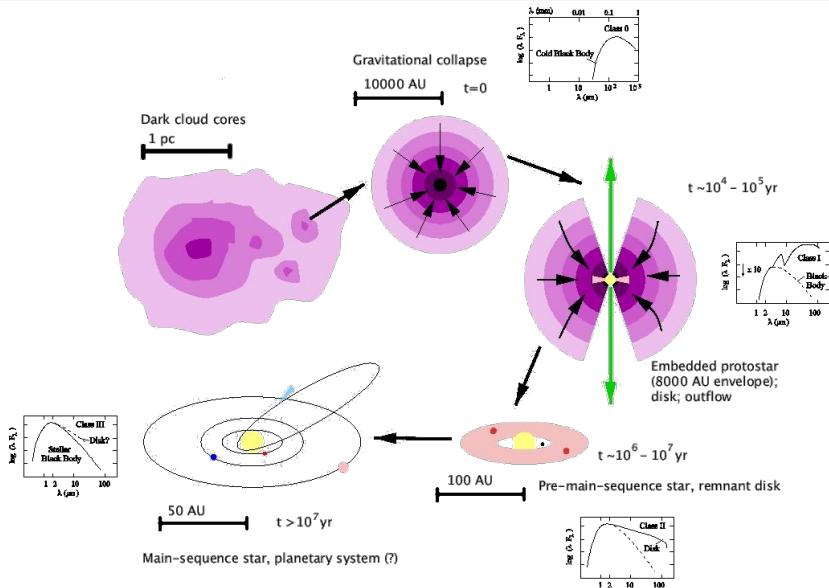
- 1 Introduction
 - Low mass SF
 - The Lambda Orionis Star Forming Region
 - Goals

- 2 Our surveys
 - Photometry and X-rays

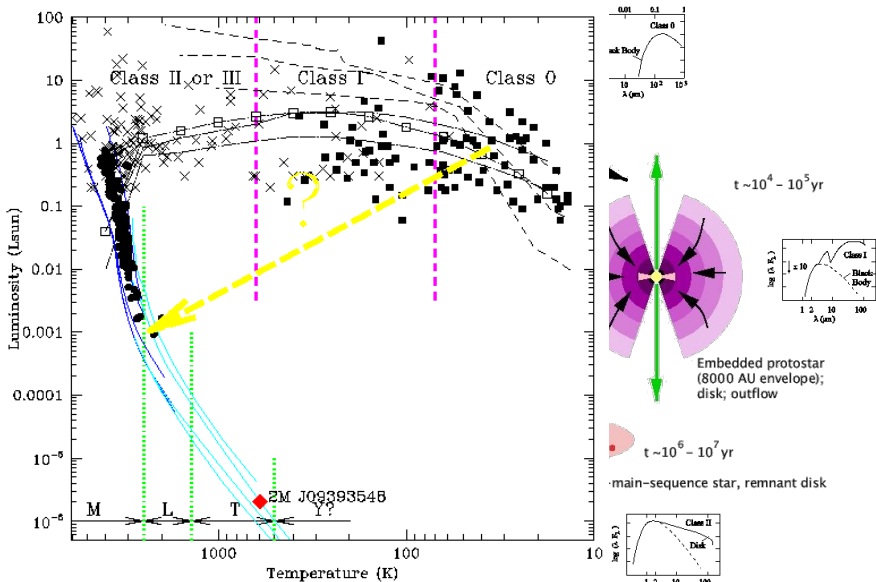
- 3 Results
 - SED analysis
 - C69 Age estimation
 - Activity and accretion
 - Disks Properties
 - Spatial distribution
 - The IMF of Collinder 69

- 4 Summary

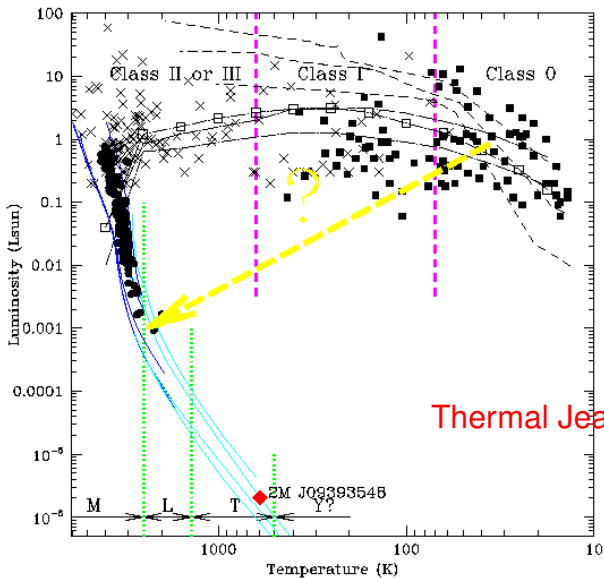
Low mass SF Theory (I)



Low mass SF Theory (I)



Low mass SF Theory (I)



Low mass SF Theory (II)

Turbulent fragmentation (*Padoan & Nordlund, 2002; Hennebelle & Chabrier, 2008*):
density enhancements → decrease the Jeans mass

Ejection scenario

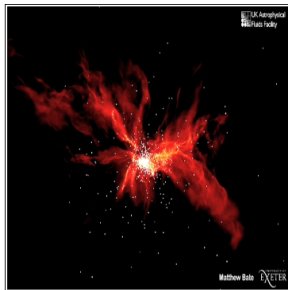
(*Reipurth & Clarke 2001*):

distribution of BDs

different than stars?

Low mass SF Theory (II)

Turbulent fragmentation (*Padoan & Nordlund, 2002; Hennebelle & Chabrier, 2008*):
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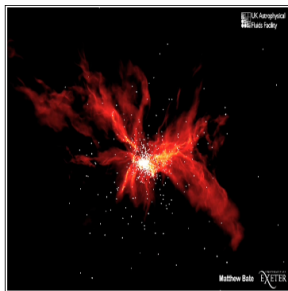


Ejection scenario
(*Reipurth & Clarke 2001*):
distribution of BDs
different than stars?

Photoevaporation
(*Whitworth & Zinnecker 2004*):
BD/star depend. on
environment?

Low mass SF Theory (II)

Turbulent fragmentation (*Padoan & Nordlund, 2002; Hennebelle & Chabrier, 2008*):
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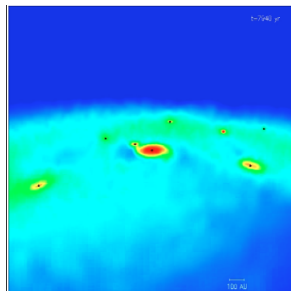
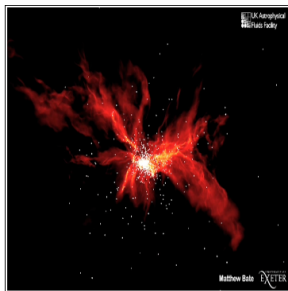
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planets

Photometric studies:

Duerr 1982

DM 1999

ByN et al 2007

Spectroscopic studies:

DM 2001, 2002

Sacco et al. (2008)

Maxted et al. (2008)

B30 ~1-2 Myr

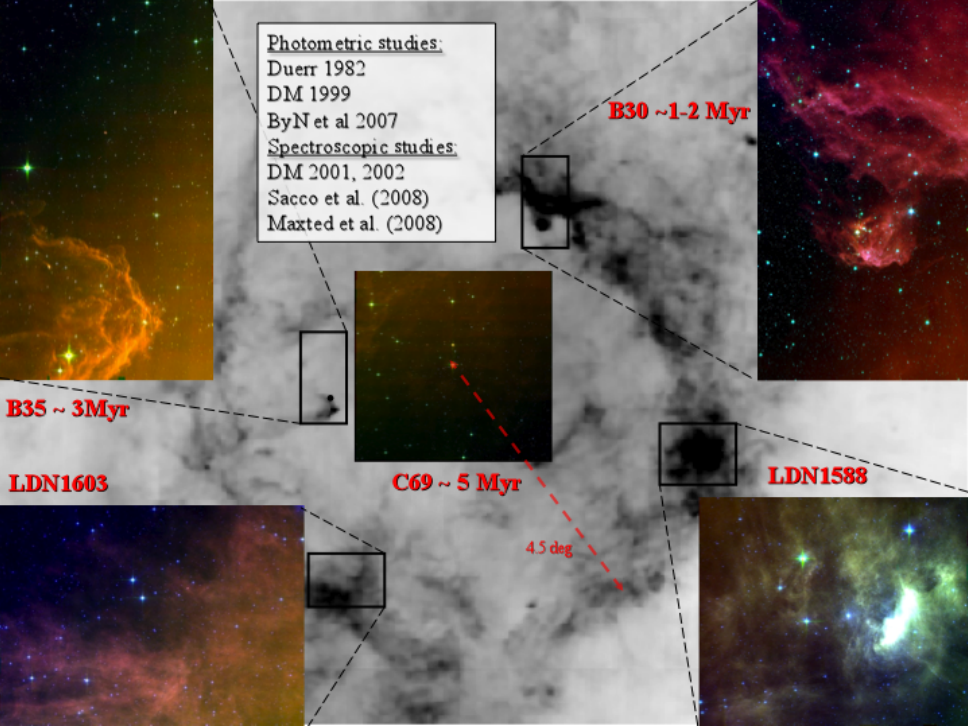
B35 ~ 3Myr

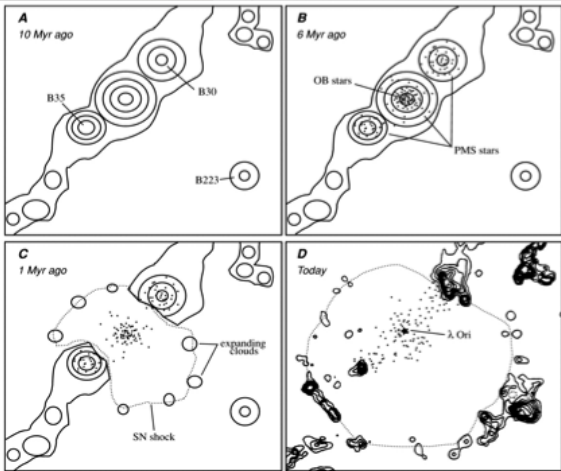
LDN1603

C69 ~ 5 Myr

45 deg

LDN1588





A. ~8–10 Myr ago, the λ Ori region was composed of a starless, roughly linear string of dense molecular clouds.

B. Over the next few Myr, stars began to form in the densest portions of this cloud chain. 6 Myr ago, a dozen OB stars formed near λ Ori's present-day position while low-mass stars formed in all productive areas of the star-forming complex.

C. ~1 Myr ago, one of the O stars became a supernova. The blast quickly dispersed all of the parent core, creating the molecular ring, the large HII region, and the nearby HI structures.

D. Today we see the fossil distribution of young stars within the molecular ring, as well as the remnants of the B30 and B35 clouds within the ionized region.

Aims

- Spectroscopically confirm the lowest mass members of the three associations (including Brown Dwarfs and IPMOS).
- Build complete census for the three regions.
- Relate properties of individual sources (acc. rates, etc.) with three different environments (ages).
- Build a very complete IMF for Collinder 69 from $\sim 20 M_{\odot}$ down to the planetary mass domain (shared mechanism of formation for low mass domain?).
- Study the disk properties and their dependence with mass.
- "Test" the Supernova hypothesis.

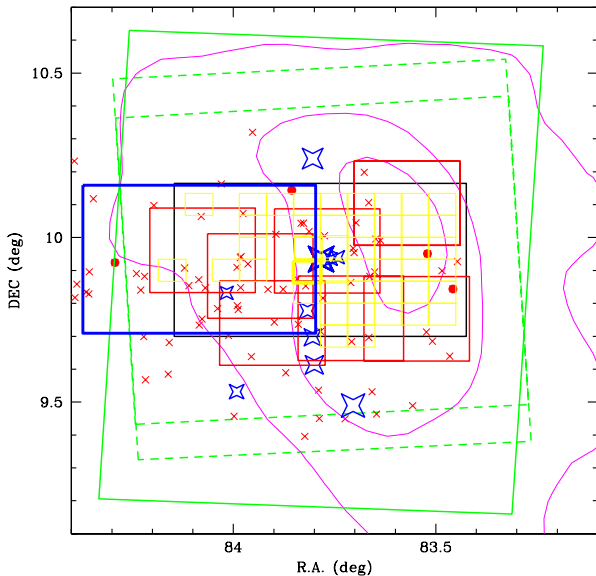
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Photometric and X-ray surveys



CFHT (optical)

IRAC & MIPS (MIR)

Omega200 (NIR)

Ingrid (NIR)

Suprime-Cam (optical)

XMM-Newton (X-rays)

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SED analysis

Theoretical model services
Documents Models Services



VOSA: VO Sed Analyzer

VO SED Analyzer



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Stars and brown dwarfs (Change)
Session: Collinder LOrI members tests (Info) (Change)
File: LOrI... tests (Info) (Change)

Upload your own data file (max size=500Kb)

It must comply with the required data format

(A small utility is available to help you to convert an original file in **ascii** (csv) or **votable** to VOSA input format)

Please, include a description for your file, it is **compulsory**

File to upload: Browse...

Description:

File type: Fluxes Magnitudes

Uploaded files

Date	Filename	Descrip
2010-04-28 23:38:59	fichero_input_final_all_errors_corrected.ascii	LOrI... tests

LOrI001

Position: (83.446583,9.9273611) Distance: 400. pc A_V : 0.36209598

Filter	SDSS_R	CFHT_R	CFHT_I	ZMASS_J	ZMASS_H	ZMASS_Ks	IRAC_I1	IRAC_I2	IRAC_I3	IRAC_I4
Amid:	6261	6582	8228	12350	16620	21590	35634	45110	57593	79594
Flux:	1.321348e-14	1.447193e-14	1.345174e-14	1.052144e-14	6.845070e-15	3.025102e-15	5.502778e-16	2.128458e-16	8.649135e-17	2.543987e-17
ΔF:	3.285918e-16	1.332914e-16	1.238951e-16	2.131932e-16	1.386999e-16	5.851066e-17	1.520474e-18	7.841528e-19	7.169533e-19	2.343098e-19

LOrI002

Position: (84.043167,10.148583) Distance: 400. pc A_V : 0.36209598

Filter	SDSS_R	CFHT_R	CFHT_I	ZMASS_J	ZMASS_H	ZMASS_Ks	IRAC_I1	IRAC_I2	IRAC_I3	IRAC_I4
Amid:	6261	6582	8228	12350	16620	21590	35634	45110	57593	79594
Flux:	8.754217e-15	1.170918e-14	1.204422e-14	1.119116e-14	8.745365e-15	4.129904e-15	7.207456e-16	2.589793e-16	1.123499e-16	3.434906e-17
ΔF:	2.015733e-16	1.078455e-16	1.109313e-16	2.473785e-16	1.852599e-16	7.227187e-17	1.991494e-18	7.155862e-19	9.313027e-19	2.530932e-19

LOrI003

Position: (83.981000,9.9420833) Distance: 400. pc A_V : 0.36209598


Bayo et al. (2008, 2012b)

How do brown dwarfs form?

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SED analysis

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Stars and brown dwarfs (Change)
Session: Collinder LOrI members tests (info) (Change)
File: LOrI... tests (info) (Change)

Coordinates
Distances
Extinction

Object coordinates


This option allows you to query Sesame VO service to search for object coordinates using the object name.
Take a look to the corresponding [Help Section](#) and [Credits Page](#) for more information.

Object	Final		User Data		Sesame	
	RA (deg)	DEC (deg)	RA (deg)	DEC (deg)	RA (deg)	DEC (deg)
LOrI001	83.446583	9.9273611	??	??	??	??
LOrI002	84.043167	10.148583	??	??	??	??
LOrI003	83.981000	9.9420833	??	??	??	??
LOrI004	83.948125	9.7640278	??	??	??	??
LOrI005	83.473542	9.7188889	??	??	??	??
LOrI006	83.817750	9.9216111	??	??	??	??
LOrI007	83.623125	9.8163056	??	??	??	??
LOrI008	83.991542	9.9091111	??	??	??	??
LOrI009	83.693083	10.109889	??	??	??	??
LOrI010	83.637333	10.144750	??	??	??	??
LOrI011	83.686083	9.8993056	??	??	??	??
LOrI012	83.774792	9.8688333	??	??	??	??
LOrI013	83.484792	9.6990833	??	??	??	??
LOrI014	84.079292	10.064111	??	??	??	??
LOrI015	83.591000	10.070694	??	??	??	??
LOrI016	83.806250	9.9234722	??	??	??	??
LOrI017	84.085375	9.8720278	??	??	??	??
LOrI018	84.069125	9.8468889	??	??	??	??
LOrI019	83.807042	9.9413333	??	??	??	??
LOrI020	83.739875	9.7687500	??	??	??	??
LOrI021	83.778917	9.8160556	??	??	??	??

Bayo et al. (2008, 2012b)

SED analysis

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Sessions	Files	Objects	VO Phot.	SED	Model Fit	Bayes Analysis	Template fit	HR Diag.	Save Results	Help	Logout
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Stars and brown dwarfs (Change) Session: Collinder LOrI members tests (info) (Change) File: LOrI... tests (info) (Change)

VO photometry

This option allows you to increase the wavelength coverage of the SEDs of your objects adding photometry from VO catalogues.
Take a look to the corresponding [Help Section](#) and [Credits Page](#) for more information.


First select the VO services that you want to use

- 2MASS All-Sky Point Source Catalog**
2MASS has uniformly scanned the entire sky in three near-infrared bands to detect and characterize point sources brighter than about 1 mJy in each band, with signal-to-noise ratio (SNR) greater than 1. More Info.
Filters: 2MASS_J 2MASS_H 2MASS_Ks
Search radius: arcsec
[Show magnitude limits](#)
- Tycho-2 Catalogue**
The Tycho-2 Catalogue is an astrometric reference catalogue containing positions and proper motions as well as two-colour photometric data for the 2.5 million brightest stars in the sky... More Info.
Filters: TYCHO_B TYCHO_V
Search radius: arcsec
[Show magnitude limits](#)
- CMC-14**
The full CMC-14 catalog (around 95.85million source in the region -30 to +50°).. More Info.
Filters: SDSS_R
Search radius: arcsec
[Show magnitude limits](#)
- Stromgren uvby-beta Catalogue (Hauck+ 1997)**
This catalogue is an updated version of the one published in 1990 (Hauck and Mermilliod, 1990) and contains data for more than 63,300 stars in the Galaxy and Magellanic Clouds... More Info.

Bayo et al. (2008, 2012b)


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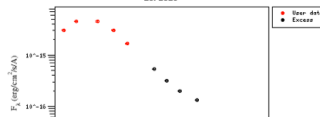
Sessions	Files	Objects	VO Phot.	SED	Model Fit	Bayes Analysis	Template fit	HR Diag.	Save Results	Help	Logout
Stars and brown dwarfs (Change)			Session: Collinder LOrI members tests (Info) (Change)						File: LOrI... tests (Info) (Change)		

Object data

LOrI029
 Position: (83.855667,10.144083) Distance: 400. pc A_V : 0.36209598
 Data for this object:

Filter	λ_{start}	Final		User		VO		
		Flux	ΔF	Flux	ΔF	Flux	ΔF	
CFHT_R	6582	3.079827e-15	2.836626e-17	3.079827e-15	2.836626e-17	---	---	Delete
CFHT_I	8228	4.579084e-15	4.217492e-17	4.579084e-15	4.217492e-17	---	---	Delete
2MASS_J	12350	4.538110e-15	1.086736e-16	4.538110e-15	1.086736e-16	---	---	Delete
2MASS_H	16820	3.085872e-15	7.673922e-17	3.085872e-15	7.673922e-17	---	---	Delete
2MASS_Ks	21590	1.670090e-15	2.922599e-17	1.670090e-15	2.922599e-17	---	---	Delete
IRAC_I1	35634	5.347884e-16	1.477675e-18	5.347884e-16	1.477675e-18	---	---	Delete
IRAC_I2	45110	3.148220e-16	8.698853e-19	3.148220e-16	8.698853e-19	---	---	Delete
IRAC_I3	57593	1.968669e-16	1.087927e-18	1.968669e-16	1.087927e-18	---	---	Delete
IRAC_I4	79594	1.322863e-16	3.655205e-19	1.322863e-16	3.655205e-19	---	---	Delete
MIPS_M1	238442	2.027081e-17	1.306907e-19	2.027081e-17	1.306907e-19	---	---	Delete

Excess detected from **IRAC_I1**. Points with larger wavelength will not be considered in model fit.
 You can manually specify where excess starts.
 Apply excess from IRAC_I1



LOrI029

● User data
● Excess

Bayo et al. (2008, 2012b)

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Services: **VOSA** Filters TSAP S3IF

VOSA

Files	Objects	VO Phot.	SED	Model Fit	Bayes Analysis	Template fit	HR Diag.	Save Results	Help	
brown dwarfs (Change)				Session: Collinder LOrI members tests (Info) (Change)			File: LOrI... tests (Info) (Change)			

Model fit

Best fit results

Object	RA	DEC	D (pc)	Model	T _{eff}	logg	M _{met.}	more	χ^2	M _J	F _{tot}	ΔF_{tot}	F _{obs} /F _{tot}	L _{bol} /L _{sun}	$\Delta L_{bol}/L_{sun}$	λ_{max}	N _H /N _{tot}	Data
LOrI001	83.445583	9.9273611	400.000	COND00	4000	2.5	0.0	---	8.03e+1	1.30e-20	1.84e-10	1.26e-12	0.49	9.19e-1	6.26e-3	79594	9/9	Syn. E
LOrI002	84.043167	10.148583	400.000	Kurucz	3750	0.00	-1.50	---	6.46e+1	1.80e-20	1.96e-10	1.42e-12	0.49	9.77e-1	7.07e-3	79594	9/9	Syn. E
LOrI003	83.981000	9.9420833	400.000	Kurucz	4000	0.00	0.20	---	1.04e+1	1.09e-20	1.59e-10	1.11e-12	0.46	7.92e-1	5.56e-3	21590	5/9	Syn. E
LOrI004	83.948125	9.7640278	400.000	NextGen	3900	5.0	0.0	---	1.98e+1	1.17e-20	1.55e-10	1.07e-12	0.45	7.71e-1	5.32e-3	21590	5/9	Syn. E
LOrI005	83.473542	9.7189889	400.000	COND00	3900	2.5	0.0	---	9.39e+1	1.34e-20	1.73e-10	1.22e-12	0.49	8.61e-1	6.09e-3	79594	9/9	Syn. E
LOrI006	83.817750	9.9216111	400.000	Kurucz	4000	0.50	0.50	---	5.29e+0	9.78e-21	1.42e-10	1.07e-12	0.48	7.07e-1	5.32e-3	21590	5/9	Syn. E
LOrI007	83.623125	9.8163056	400.000	NextGen	4000	5.5	0.0	---	2.50e+0	8.76e-21	1.27e-10	9.46e-13	0.45	6.33e-1	4.72e-3	21590	5/9	Syn. E
LOrI008	83.991542	9.9091111	400.000	Kurucz	4000	0.50	-2.50	---	4.63e+1	1.00e-20	1.43e-10	1.10e-12	0.49	7.13e-1	5.49e-3	79594	9/9	Syn. E
LOrI009	83.693083	10.109889	400.000	NextGen	4000	3.5	0.0	---	1.32e+1	8.29e-21	1.18e-10	8.44e-13	0.48	5.90e-1	4.21e-3	79594	9/9	Syn. E
LOrI010	83.637333	10.144750	400.000	NextGen	4200	5.0	0.0	---	4.25e+1	6.54e-21	1.14e-10	8.37e-13	0.48	5.67e-1	4.17e-3	79594	9/9	Syn. E
LOrI011	83.686083	9.8993056	400.000	Kurucz	3750	0.00	-0.50	---	1.62e+1	1.20e-20	1.33e-10	1.04e-12	0.49	6.62e-1	5.19e-3	79594	9/9	Syn. E
LOrI012	83.774792	9.8688333	400.000	Kurucz	4000	2.50	0.50	---	6.91e+1	8.76e-21	1.23e-10	8.96e-13	0.47	6.12e-1	4.47e-3	79594	9/9	Syn. E
LOrI013	83.484792	9.8990833	400.000	NextGen	3900	4.5	0.0	---	2.10e+1	8.85e-21	1.18e-10	8.37e-13	0.45	5.86e-1	4.17e-3	21590	5/9	Syn. E
LOrI014	84.079292	10.064111	400.000	Kurucz	3750	4.00	-2.00	---	8.59e-1	9.25e-21	1.04e-10	7.53e-13	0.48	5.17e-1	3.75e-3	21590	5/9	Syn. E
LOrI015	83.591000	10.070694	400.000	Kurucz	4000	2.50	0.00	---	2.29e+1	7.61e-21	1.10e-10	7.93e-13	0.49	5.50e-1	3.95e-3	79594	9/9	Syn. E
LOrI016	83.806250	9.9234722	400.000	Kurucz	3500	2.50	-2.50	---	6.85e+0	1.12e-20	9.51e-11	7.21e-13	0.46	4.74e-1	3.60e-3	21590	5/9	Syn. E
LOrI017	84.085375	9.8720278	400.000	NextGen	4200	5.0	0.0	---	8.44e+0	5.13e-21	8.91e-11	6.13e-13	0.48	4.44e-1	3.06e-3	79594	9/9	Syn. E
LOrI018	84.069125	9.8468889	400.000	Kurucz	3500	2.00	-2.50	---	1.67e+1	1.04e-20	8.88e-11	6.49e-13	0.47	4.43e-1	3.24e-3	21590	5/9	Syn. E
LOrI019	83.807042	9.9413333	400.000	COND00	3900	2.5	0.0	---	1.49e+1	6.57e-21	8.64e-11	6.54e-13	0.46	4.31e-1	3.26e-3	21590	5/9	Syn. E
LOrI020	83.739875	9.7687500	400.000	NextGen	3800	5.0	0.0	---	1.34e+1	9.52e-21	9.16e-11	7.59e-13	0.44	4.57e-1	3.79e-3	21590	5/9	Syn. E
LOrI021	83.778917	9.8160556	400.000	Kurucz	3750	2.50	-2.50	---	1.92e+1	6.86e-21	7.69e-11	5.95e-13	0.50	3.83e-1	2.97e-3	79594	9/9	Syn. E
LOrI022	83.963958	9.9196667	400.000	NextGen	3800	5.0	0.0	---	2.89e+1	7.05e-21	8.31e-11	5.78e-13	0.48	4.15e-1	2.89e-3	57593	8/9	Syn. E
LOrI023	83.990208	9.7929444	400.000	NextGen	3900	5.0	0.0	---	2.63e+1	6.10e-21	7.86e-11	5.84e-13	0.48	3.92e-1	2.91e-3	79594	9/9	Syn. E
LOrI024	83.737958	9.9100279	400.000	COND00	3900	2.5	0.0	---	2.00e+1	5.86e-21	7.69e-11	6.46e-13	0.46	3.84e-1	3.23e-3	21590	5/9	Syn. E
LOrI025	84.084083	9.7338889	400.000	Kurucz	3500	1.50	-2.50	---	1.57e+1	9.26e-21	7.61e-11	9.72e-13	0.46	3.89e-1	3.36e-3	21590	5/9	Syn. E

SED analysis

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Services: [VOSA](#) [Filters](#) [TSAP](#) [S3IF](#)

VOSA

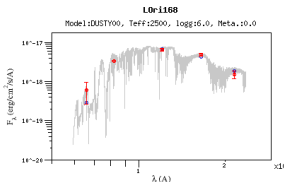
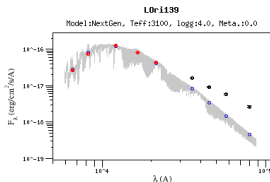
Files	Objects	VO Phot.	SED	Model Fit	Bayes Analysis	Template fit	HR Diag.	Save Results	Help
Own dwarfs (Change)		Session: Collinder LOrI members tests (Info) (Change)				File: LOrI... tests (Info) (Change)			

Model fit

Best fit results

 Hide graphs Delete this fit

Object	RA	DEC	D (pc)	Model	T_{eff}	logg	Meta.	more	χ^2	M_J	F_{tot}	ΔF_{tot}	$F_{\text{obs}}/F_{\text{tot}}$	$L_{\text{bol}}/L_{\text{sun}}$	$\Delta L_{\text{bol}}/L_{\text{sun}}$	λ_{max}	$N_{\text{H}}/N_{\text{tot}}$	Data
LOrI001	83.445583	9.9273611	400.000	COND00	4000	2.5	0.0	—	8.03e+1	1.30e-20	1.84e-10	1.26e-12	0.49	9.19e-1	6.26e-3	79594	9/9	Syn.Σ
LOrI002	84.043167	10.148583	400.000	Kurucz	3750	0.00	-1.50	—	6.46e+1	1.80e-20	1.96e-10	1.42e-12	0.49	9.77e-1	7.07e-3	79594	9/9	Syn.Σ
LOrI003	83.981000	9.9420833	400.000	Kurucz	4000	0.00	0.20	—	1.04e+1	1.09e-20	1.59e-10	1.11e-12	0.46	7.92e-1	5.56e-3	21590	5/9	Syn.Σ
LOrI004	83.948125	9.7640278	400.000	NextGen	3900	5.0	0.0	—	1.99e+1	1.17e-20	1.55e-10	1.07e-12	0.45	7.71e-1	5.32e-3	21590	5/9	Syn.Σ
LOrI005	83.473542															79594	9/9	Syn.Σ
LOrI006	83.817750															21590	5/9	Syn.Σ
LOrI007	83.623125															21590	5/9	Syn.Σ
LOrI008	83.991542															79594	9/9	Syn.Σ
LOrI009	83.693083															79594	9/9	Syn.Σ
LOrI010	83.637333															79594	9/9	Syn.Σ
LOrI011	83.686083															79594	9/9	Syn.Σ
LOrI012	83.774792															79594	9/9	Syn.Σ
LOrI013	83.484792															21590	5/9	Syn.Σ
LOrI014	84.079292															21590	5/9	Syn.Σ
LOrI015	83.591000															79594	9/9	Syn.Σ
LOrI016	83.806250															21590	5/9	Syn.Σ
LOrI017	84.085375															79594	9/9	Syn.Σ
LOrI018	84.069125															21590	5/9	Syn.Σ
LOrI019	83.807042															21590	5/9	Syn.Σ
LOrI020	83.739875															21590	5/9	Syn.Σ
LOrI021	83.778917															79594	9/9	Syn.Σ
LOrI022	83.963958	9.9196667	400.000	NextGen	3800	5.0	0.0	—	2.89e+1	7.05e-21	8.31e-11	5.78e-13	0.48	4.15e-1	2.88e-3	57593	8/9	Syn.Σ
LOrI023	83.990208	9.7929444	400.000	NextGen	3900	5.0	0.0	—	2.63e+1	6.10e-21	7.86e-11	5.84e-13	0.48	3.92e-1	2.91e-3	79594	9/9	Syn.Σ
LOrI024	83.737958	9.9100278	400.000	COND00	3900	2.5	0.0	—	2.00e+1	5.86e-21	7.69e-11	6.46e-13	0.46	3.84e-1	3.23e-3	21590	5/9	Syn.Σ
LOrI025	84.084083	9.7338889	400.000	Kurucz	3500	1.50	-2.50	—	1.57e+1	9.26e-21	7.81e-11	9.72e-13	0.46	3.89e-1	4.39e-3	21590	5/9	Syn.Σ



SED analysis

Theoretical model services Documents Models Services

SVO SED Stellar Parameters

VOSA: VO Sed Analyzer
VO SED Analyzer

Services: VOSA Filters TSAP S3if My data LogOut

VOSA

Sessions	Files	Objects	VO Phot.	SED	Model Fit	Bayes Analysis	Template fit	HR Diag.	Save Results	Help	Logout
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Stars and brown dwarfs (Change) Session: Collinder LOrI members tests (info) (Change) File: LOrI... tests (info) (Change)

Model Bayes analysis

This option allows you to estimate some physical properties (such as effective temperature, surface gravity and luminosity) for each object comparing its SED with those derived from theoretical spectra obtained from VO services and using a Bayesian analysis to estimate the probability for each parameter value.

Take a look to the corresponding [Help Section](#) and [Credits Page](#) for more information.

First select the models that you want to use for the analysis

- The NextGen Model Atmosphere grid.**
The NextGen Model Atmosphere grid for T_{eff} between 3000 and 10,000K; Hauschildt, P.H., Allard, F., Baron, E., Schweitzer, A., ApJ 312, 377, 1999
- The DUSTY00 Model Atmosphere grid.**
The DUSTY00 Model Atmosphere grid. Allard et al. 2001, ApJ, 556, 357
- The COND00 Model Atmosphere grid.**
The COND00 Model Atmosphere grid. Chabrier et al. 2000, ApJ, 542,464
- Kurucz ATLAS9, ODFNEW /NOVER models**
ODFNEW /NOVER models. Newly computed ODFs with better opacities and better abundances have been used. (The convective treatment is described in Castelli et al. 1997, AA 318, 841)
- Husfeld et al models for non-LTE Helium-rich stars**
Husfeld et al models for non-LTE Helium-rich stars Husfeld, D.; Butler, K.; Heber, U.; Drilling, J. S., 1989 A&A 222, 150
- TLUSTY OSTAR2002+BSTAR2006**
TLUSTY OSTAR2002+BSTAR2006 Grid, The merged files use the BSTAR2006 models for effective temperatures up to 30,000 K and the OSTAR2002 models for higher temperatures. Lanz, T., Hubeny, I. 2003, ApJS, 146, 417 Lanz, T., Hubeny, I. 2007, ApJS, 169, 83

Bayo et al. (2008, 2012b)

SED analysis

Theoretical model services Documents Models Services

SVO
Stellar Virtual Observatory

VOSA: VO Sed Analyzer
VO SED Analyzer

Services: VOSA Filters TSAP S3if My data LogOut

VOSA

Sessions	Files	Objects	VO Phot.	SED	Model Fit	Bayes Analysis	Template fit	HR Diag.	Save Results	Help	Logout
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Stars and brown dwarfs (Change) Session: Collinder LOrI members tests (info) (Change) File: LOrI... tests (info) (Change)


Model Bayes analysis

The analysis process can take up to some minutes

The waiting time will depend on how many data you want to analyze, how many models you are using and if you have chosen to use a wide range of parameters or not.

Right now we are querying the model servers and performing the analysis.

Please, be patient.




Getting data for LOrI001. ...
Getting data for LOrI002. ...
Getting data for LOrI003. ...
Getting data for LOrI004. ...
Getting data for LOrI005. ...
Getting data for LOrI006. ...
Getting data for LOrI007. ...
Getting data for LOrI008. ...
Getting data for LOrI009. ...
Getting data for LOrI010. ...
Getting data for LOrI011. ...
Getting data for LOrI012. ...
Getting data for LOrI013. ...
Getting data for LOrI014. ...
Getting data for LOrI015. ...

Bayo et al. (2008, 2012b)


SED analysis

Theoretical model services
Documents Models Services



VOSA: VO Sed Analyzer

VO SED Analyzer



Services: VOSA Filters TSAP S3if
My data LogOut

VOSA

Sessions	Files	Objects	VO Phot.	SED	Model Fit	Bayes Analysis	Template fit	HR Diag.	Save Results	Help	Logout
Stars and brown dwarfs (Change)			Session: Collinder LOr members tests (info) (Change)				File: LOr... tests (info) (Change)				

Model Bayes analysis

LOri001

Here you can see, for each model, the relative probability found for each parameter.
Only those with a probability higher than 1e-5 are shown.

The NextGen Model Atmosphere grid.

Meta.	Probability	logg	Probability	T _{eff}	Probability
0.0	1.000000	5.0	0.999242	4000	1.000000
		5.5	0.000756		

The DUSTY00 Model Atmosphere grid.

logg	Probability	T _{eff}	Probability
5.0	0.965784	3900	1.000000
5.5	0.034216		

The COND00 Model Atmosphere grid.

logg	Probability	T _{eff}	Probability
2.5	0.891237	4000	1.000000
3.0	0.108763		

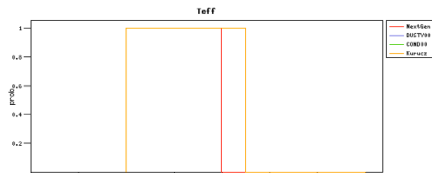
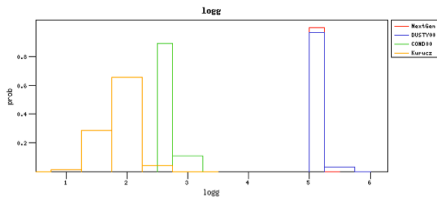
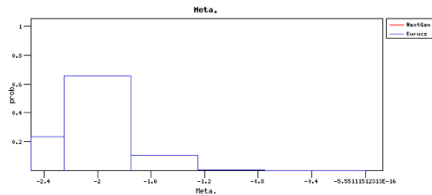
Kurucz ATLAS9, ODFNEW /NOVER models

Meta.	Probability	logg	Probability	T _{eff}	Probability
-2.50	0.233853	0.50	0.000167	4000	1.000000
LOr021	-2.00	0.657809	1.00	0.016678	
LOr022	-1.50	0.103494	1.50	0.285839	
LOr023	-1.00	0.004745	2.00	0.655479	
LOr024	-0.50	0.000099	2.50	0.041791	
LOr025			3.00	0.000046	

Meta.
NextGen

Bayo et al. (2008, 2012b)

SED analysis

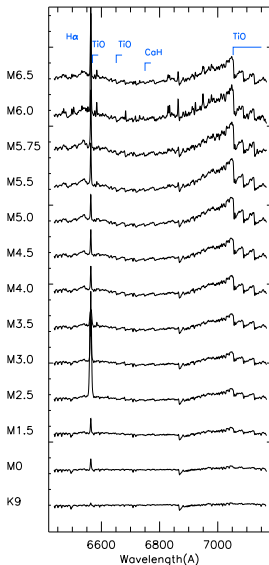
L Ori 026
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L Ori 067
L Ori 068

Bayo et al. (2008, 2012b)

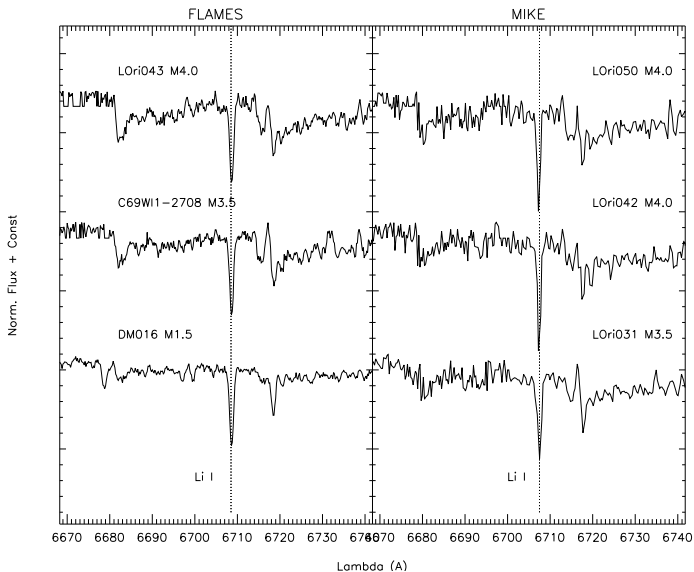
Spectroscopic follow-up

Spectroscopic confirmation of candidates

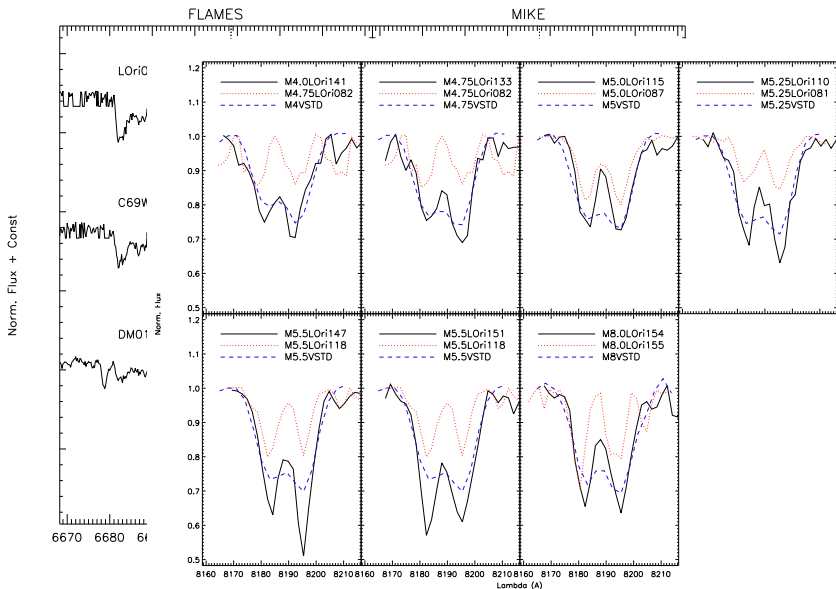
- Alkali lines \Rightarrow youth indicators
- Emission lines \Rightarrow activity and accretion



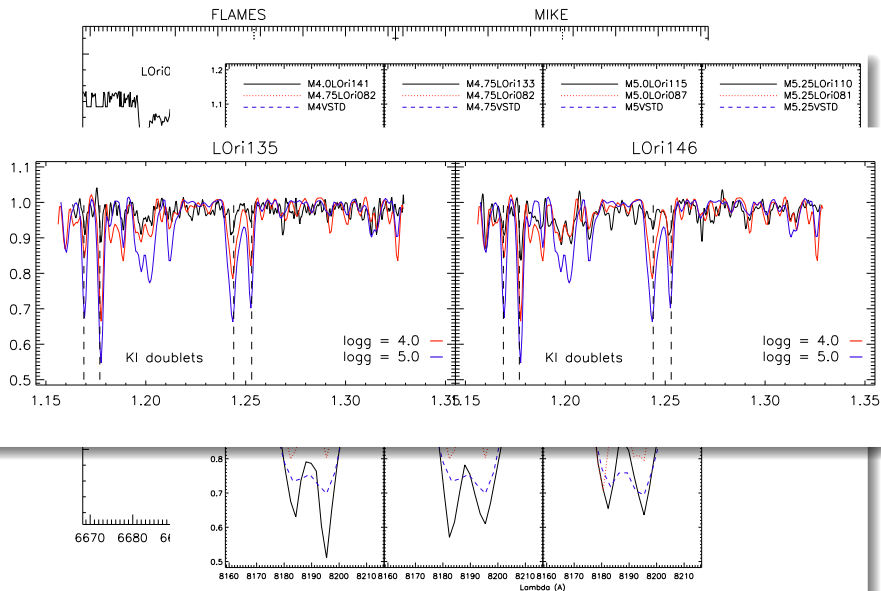
Alkali: signpost of youth



Alkali: signpost of youth

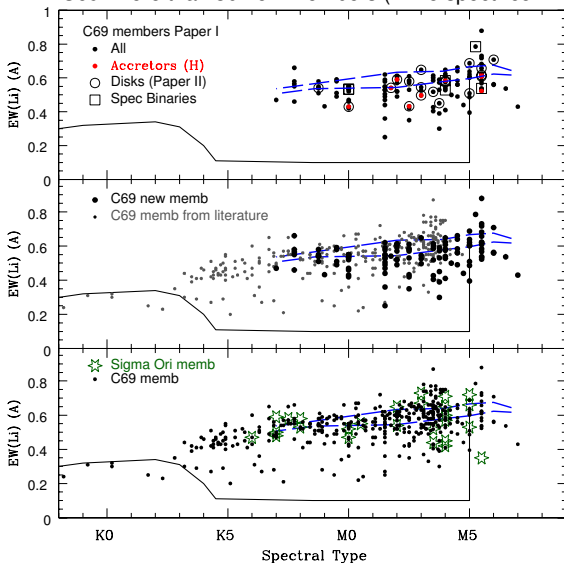


Alkali: signpost of youth



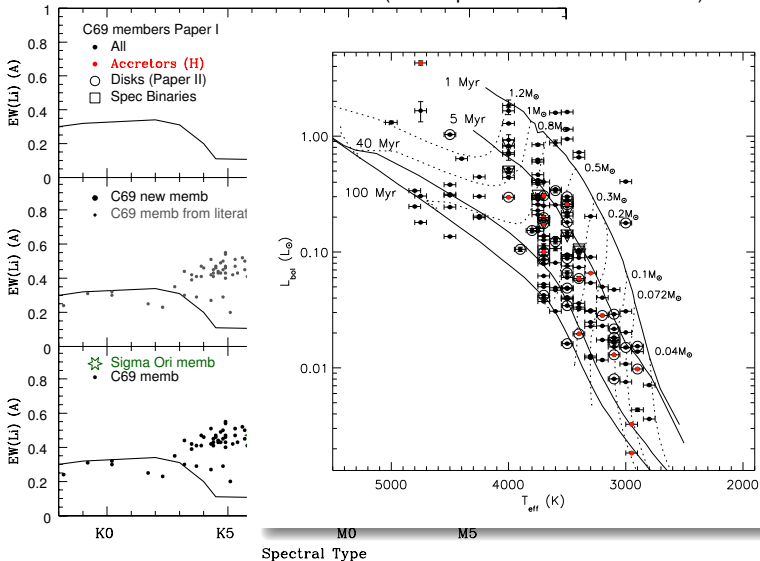
The youth of C69

C69: More than 30 new members (~175 spect. confirmed members)

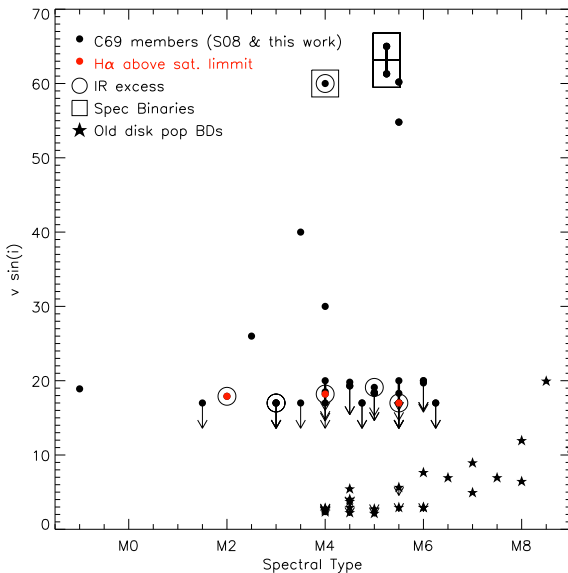


The youth of C69

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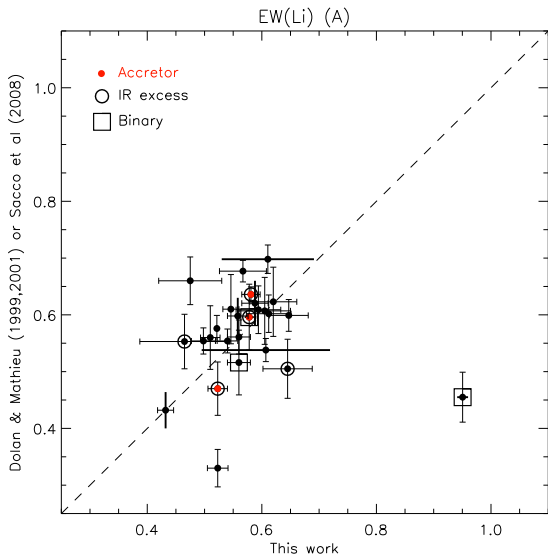


The youth of C69 (II)



- Faster rotators than old BDs.
- Disk locking?

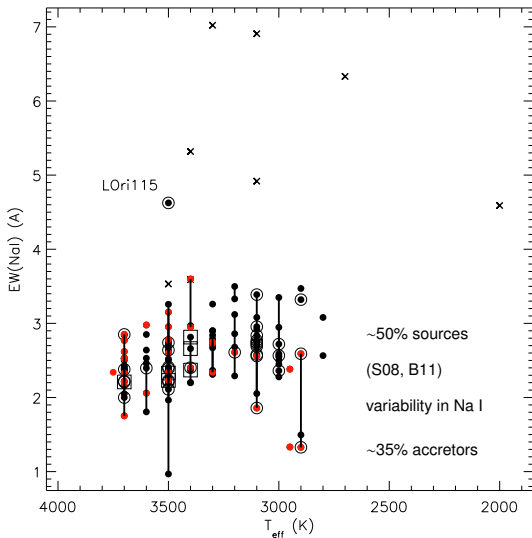
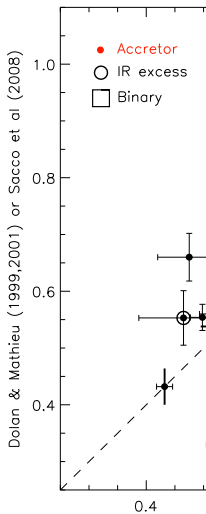
Variability: alkali



~30% sources (DM,
S08, B11) variability in
Li I

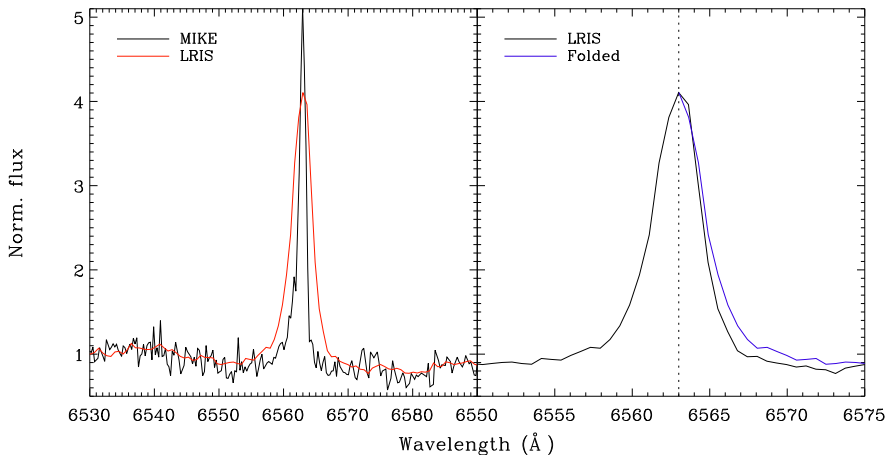
All Active stars (Xrays
or H α variability)

Variability: alkali

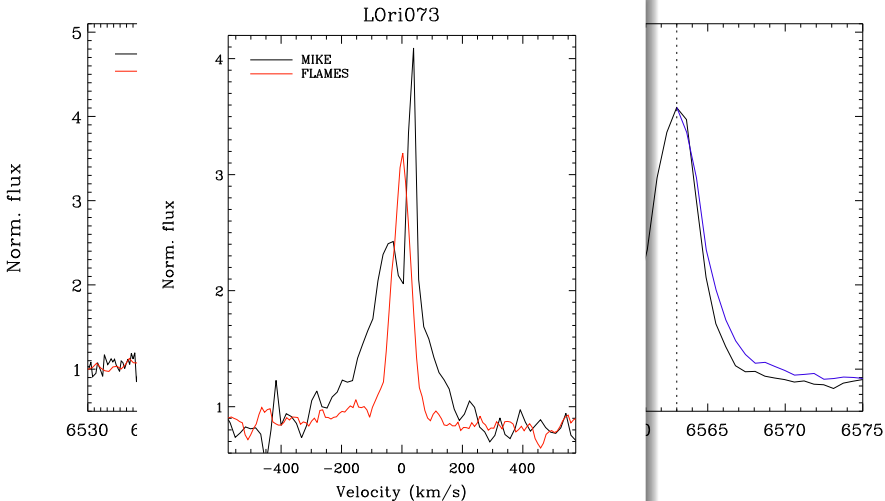


Variability: $H\alpha$

L Ori 068



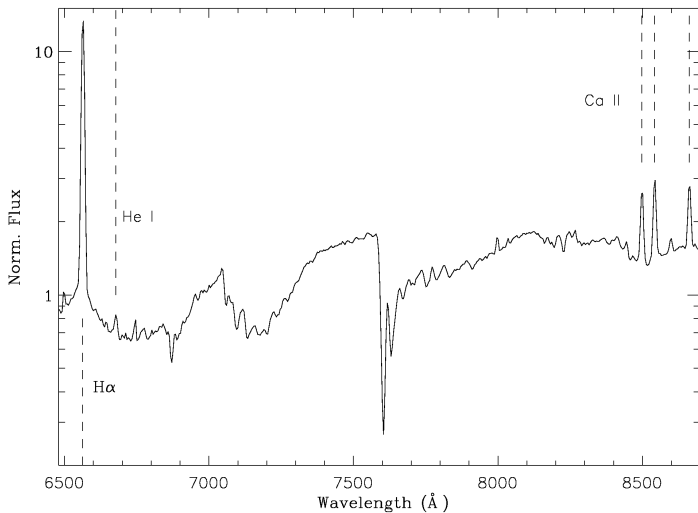
Asymmetry in the "flared" state. Mass movement

Variability: H α 

Asymmetry in the "flared" state. Mass movement

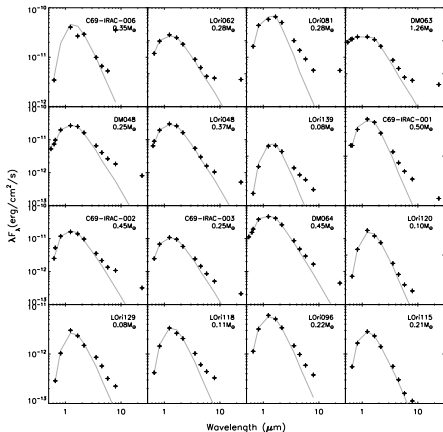
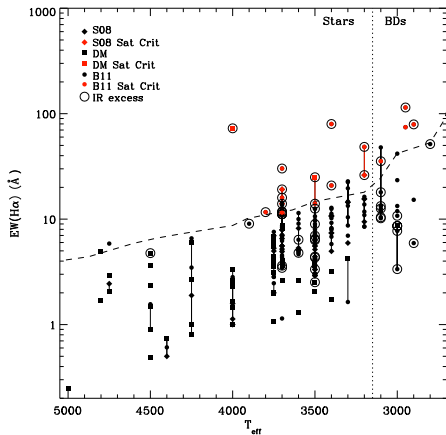
Presence of winds

Activity and accretion through emission lines



Distinguishing between accretion and activity

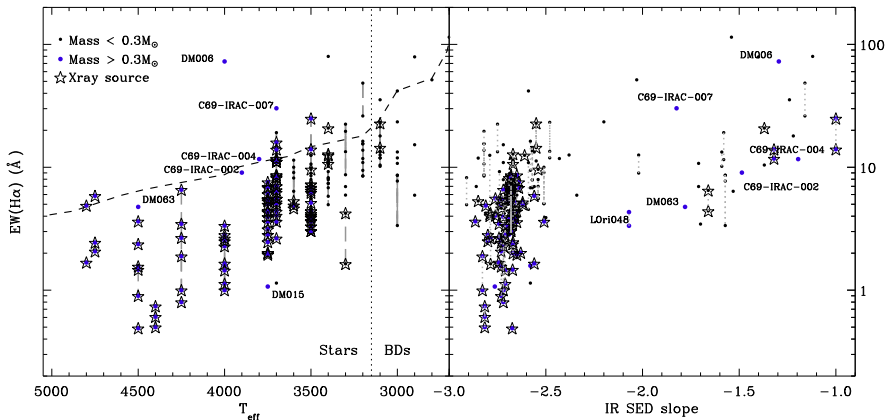
~65% disk-harboring non-accretors



Saturation criteria Barrado y Navascués & Martin (2003)

Distinguishing between accretion and activity

~65% disk-harboring non-accretors



Saturation criteria Barrado y Navascués & Martin (2003)

Disks Properties and distribution

Disk and diskless populations unevenly distributed ⇒ **Not consistent with SN hypothesis.**

Dichotomy at $M_* \sim 0.6M_{\odot}$

Stellar disk fraction 26.3%

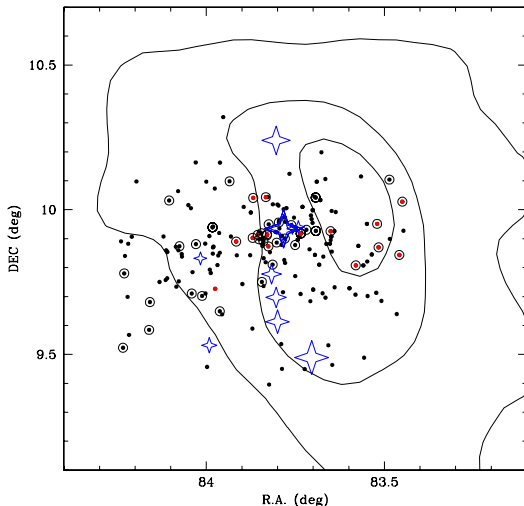
Sub-stellar disk fraction <58%

Barrado y Navascués et al. (2004) 40%

Scholz et al. (2007) 37.6% for Upper Sco

Acc. frac. sub-stellar 30–43%

Scholz et al. (2007) 31% for Upper Sco (low-mass and sub-stellar)



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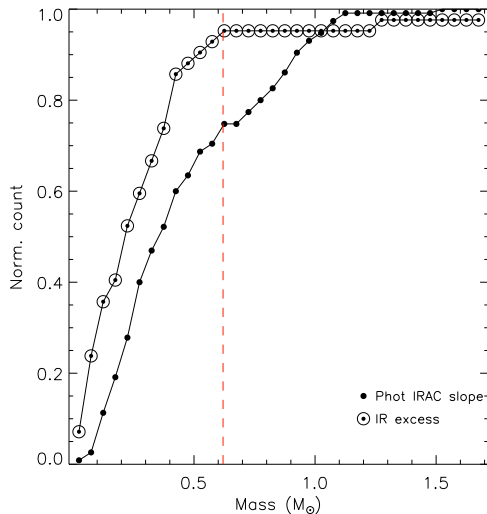
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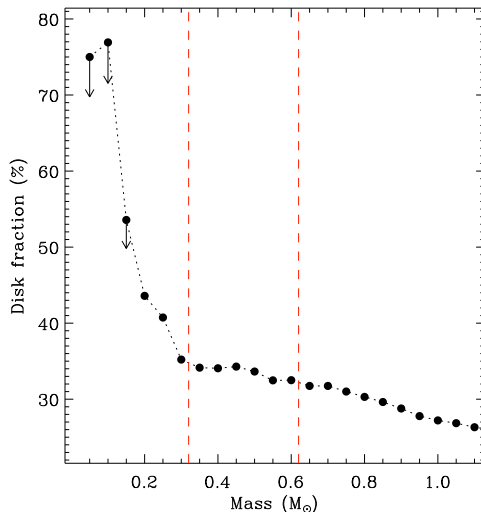
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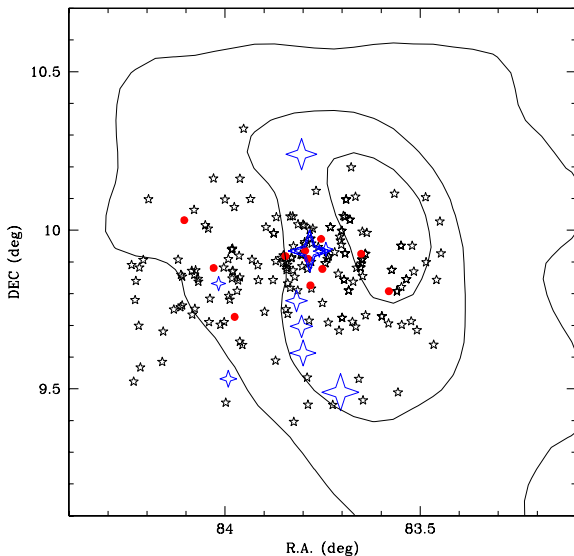
Scholz et al. (2007) 37.9% for Upper-Sco

Acc. frac. sub-stellar 30–43%

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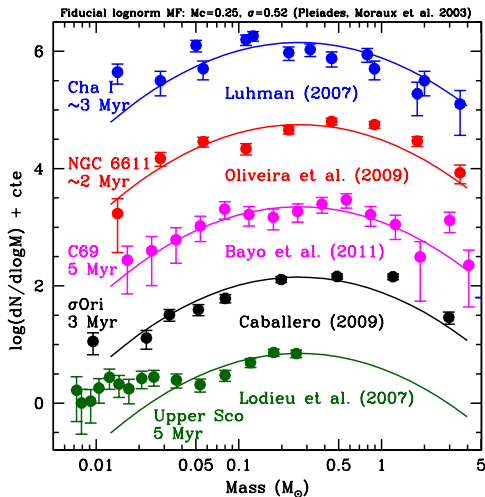
Spatial distribution of the members



Homogeneous
distribution of both
BDs and stars

⇒ Caveats to
ejection scenario

IMF of Collinder 69



$$R_{SS} = \frac{N(0.02 \leq M/M_{\odot} \leq 0.08)}{N(0.08 \leq M/M_{\odot} \leq 10)}$$

Briceño et al. (2002)

Collinder 69 \Rightarrow 0.06

~ Taurus

Briceño et al. (2002)

< Taurus

revised by Guieu et al (2006)

< ONC

Kroupa et al. (2003)

- 1 Introduction
 - Low mass SF
 - The Lambda Orionis Star Forming Region
 - Goals

- 2 Our surveys
 - Photometry and X-rays

- 3 Results
 - SED analysis
 - C69 Age estimation
 - Activity and accretion
 - Disks Properties
 - Spatial distribution
 - The IMF of Collinder 69

- 4 Summary

Summary

- Complete census of ~ 175 spectroscopically confirmed members.
- Physical parameters derived for the spectroscopic sample: Spectral Type, $H\alpha$ and Li I equivalent width, accretion rates, etc.
- Age study: upper limit of 20 Myr, optimal 5 Myr.
- $v\sin(i)$ estimation and relation with disk presence.
- Variability on absorption and emission lines.
- Study of the disks distrib: Not consistent with SN scenario.
- Complete study on disk fraction dependence on mass.
- No evidence of mass segregation (caveats on ejection scenario for BD formation)
- One of the most complete spectroscopic IMF reported so far (from $\sim 20 M_{\odot}$ down to $20 M_{\text{Jup}}$).

Barrado y Navascués et al. (2004, 2007, 2011) Bayo et al. (2011, 2012a)

THANK YOU!!!



Remember to use the right tool....