

Large-scale Galactic massive star surveys

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The science

1. Fundamental spectral morphology and the properties of O stars
2. The multiplicity of massive stars
3. The ISM, the Galactic extinction law, and DIBs
4. The distribution of massive stars and dust in the solar neighborhood
5. The massive-star IMF

Survey descriptions

	Survey	PI	#	# O	Resol.	Sample	Spectral types	Epochs	Done
Interm. resol.	GOSSS	Maíz Apellániz	2500	1500	2500	N+S	O (+ B + WR)	I-10	60%
Imaging	AstraLux	Maíz Apellániz	1000	700	100 mas	N	O (+ B + WR)	I-2	75%
	AstraLux Sur	Maíz Apellániz	800	550	70 mas	S	O (+ B + WR)	I	0%
High resol.	OWN	Barbá + Morrell	300	250	15 000 - 46 000	S	O + WN	10	85%
	IACOB	Simón Díaz	250	153	23 000 - 46 000	N	O + B	I-10	99%
	IACOB-sweG	Negueruela	100	60	85 000	N	O + B	I	80%
	NoMaDS	Pellerin	200	150	30 000	dim N	O (+ B + WR)	I-5	70%
	CAFÉ-BEANS	Negueruela	100	100	65 000	N	O	10	15%

GOSSS description

- Long-slit spectroscopy of ~ 2500 stars with $R \sim 2500$ and $S/N > 200$ in $3900\text{--}5100 \text{ \AA}$
 - ★ OSN 1.5 m (Albireo): $\delta > -20^\circ, B < 11$
 - ★ CAHA 3.5 m (TWIN): $\delta > -20^\circ, B > 11$ continued with WHT 4.2 m (ISIS)
 - ★ LCO 2.5 m (B&C): $\delta < -20^\circ$ possible Gemini extension
- Initial selection from the Galactic O-Star Catalog (GOSC)
- 1398 stars (2311 spectra) processed (+ ~ 100 unproc.), compl. for $B < 8$
- Description in Maíz Apellániz et al. (2011) [arXiv:1010.5680, SEA IX]
- First big paper published: Sota et al. (2011), ApJS 193, 24
- Second big paper in 2013.
- Other results: ApJL 711, 143; AJ 142, 150; MNRAS 425, 1278
- Devoted pipeline
- MGB: Code for spectral classification
- PhD thesis of Alfredo Sota (2011)

GOSSS and the other surveys

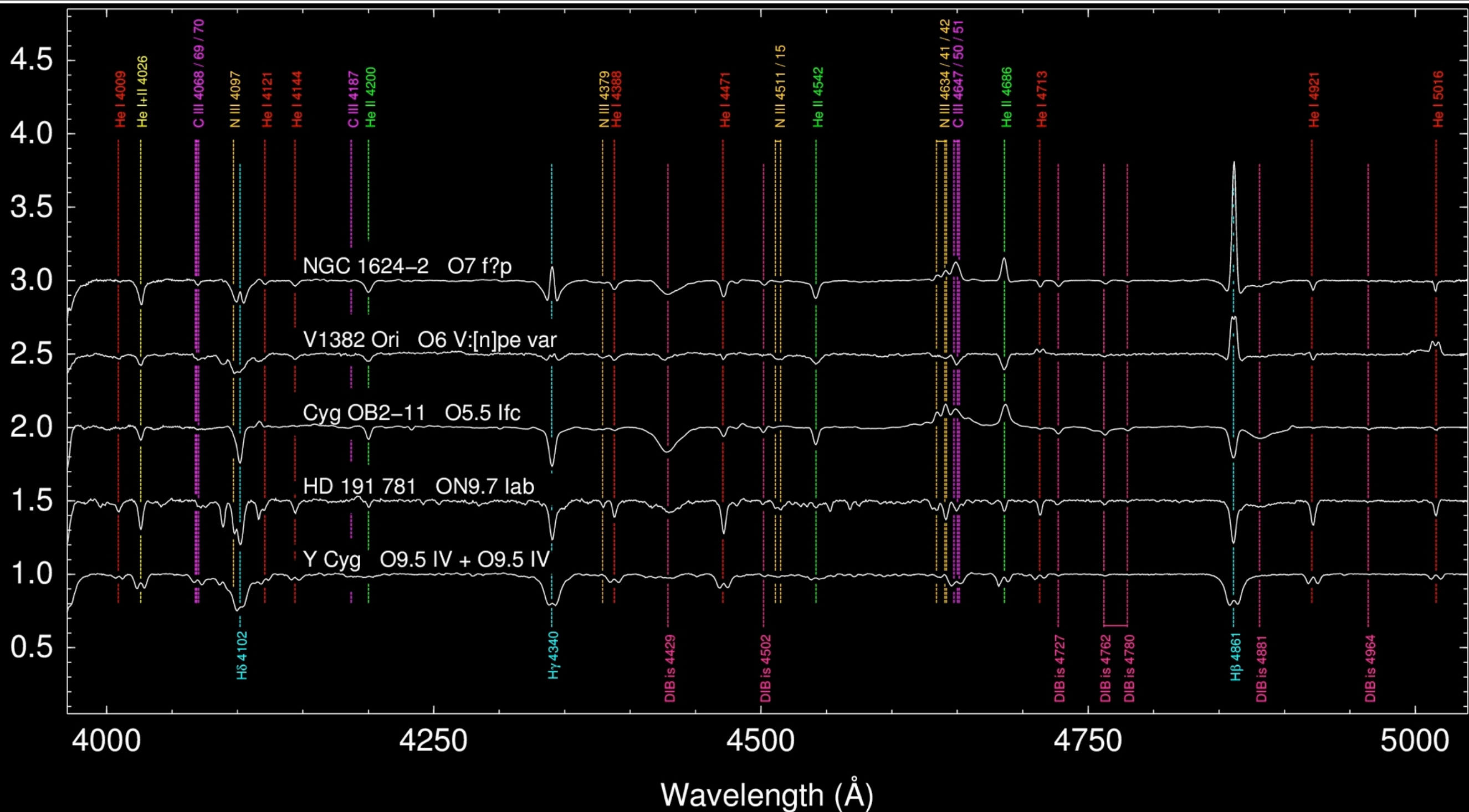
- GOSSS:
 - ★ Largest uniform sample of O stars ever
 - ★ Spectral types + temperatures + gravities
 - ★ Intense and/or broad Diffuse Interstellar Bands (DIBs) in the blue-violet region
 - ★ Spatial distribution, extinction, and IMF to several kpc
 - ★ Extreme binaries
- Why other surveys?
 - ★ AstraLux + AstraLux Sur (high-resolution imaging):
 - ➔ Spatial resolution of close pairs
 - ★ High resolution spectroscopy:
 - ➔ Rest of optical region ($H\alpha$...) D
 - ➔ Detailed modeling
 - ➔ SB2 detection and orbit follow-up
 - ➔ Weak DIBs and extension to the full optical range

GOSC and GOSSS

- Origins (2004-2009):
 - ★ v1.0: Maíz Apellániz et al. (2004), 378 confirmed O stars
 - ★ v2.0: Sota et al. (2008), ~1300 confirmed and candidate O stars
- Recent (2010-12):
 - ★ v2.3, new version and URL: <http://gosc.iaa.es>
 - ★ MySQL+ IDL-based redesign
 - ★ Searches, HTML and Aladin output
 - ★ New candidates and corrections
- Future (2013-):
 - ★ v3.0: Incorporation of GOSSS results into GOSC
 - ★ New spectral types
 - ★ Data (spectra)

Fundamental spectral morphology and the properties of O stars

The O-star zoo
in the $R \sim 2500$
GOSSS data



OWN description

- First (chronologically) of the surveys (2006-)
- 300 southern stars
- High resolution (15 000 - 46 000)
- Four observatories: LCO, La Silla, Tololo, CASLEO
- Multiple epochs: Conceived with spectroscopic-binary detection + orbit measurement as primary objective
- The fraction of spectroscopic multiples grows from 19% to 60%

NoMaDS description

- Northern Massive Dim Stars
- 9 m Hobby-Eberly Telescope
- 30 000 resolution (~IACOB, OWN...)
- Why add dim stars?
 - ★ Scarcity of some spectral types in IACOB and OWN
 - ★ Access to Cyg OB2 at high resolution
 - ★ The ISM

The surveys and Gaia

- Why do surveys of massive stars now?

- ★ Agents of change
- ★ Scarce and hard to find
- ★ Need to get ready for Gaia

- What can we learn from the surveys?

- ★ Identification and characterization
- ★ Multiplicity
- ★ Spatial distribution and statistical properties

Gaia contribution

Average

Good

Good/Excellent