The Evolution of C/O in Low Metallicity Galaxies

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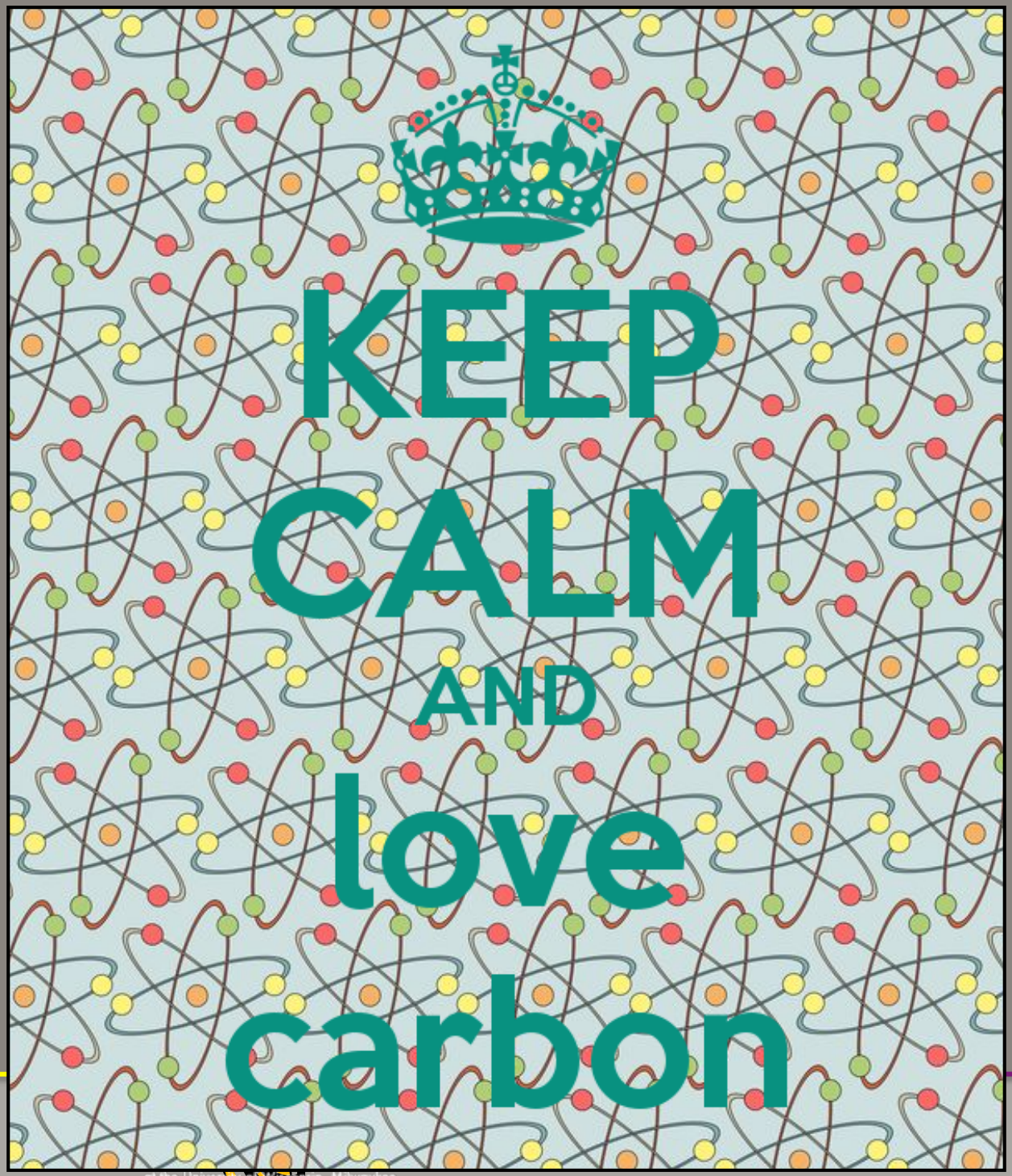
I. Why C?

Stellar Isochrones

CO Molecules

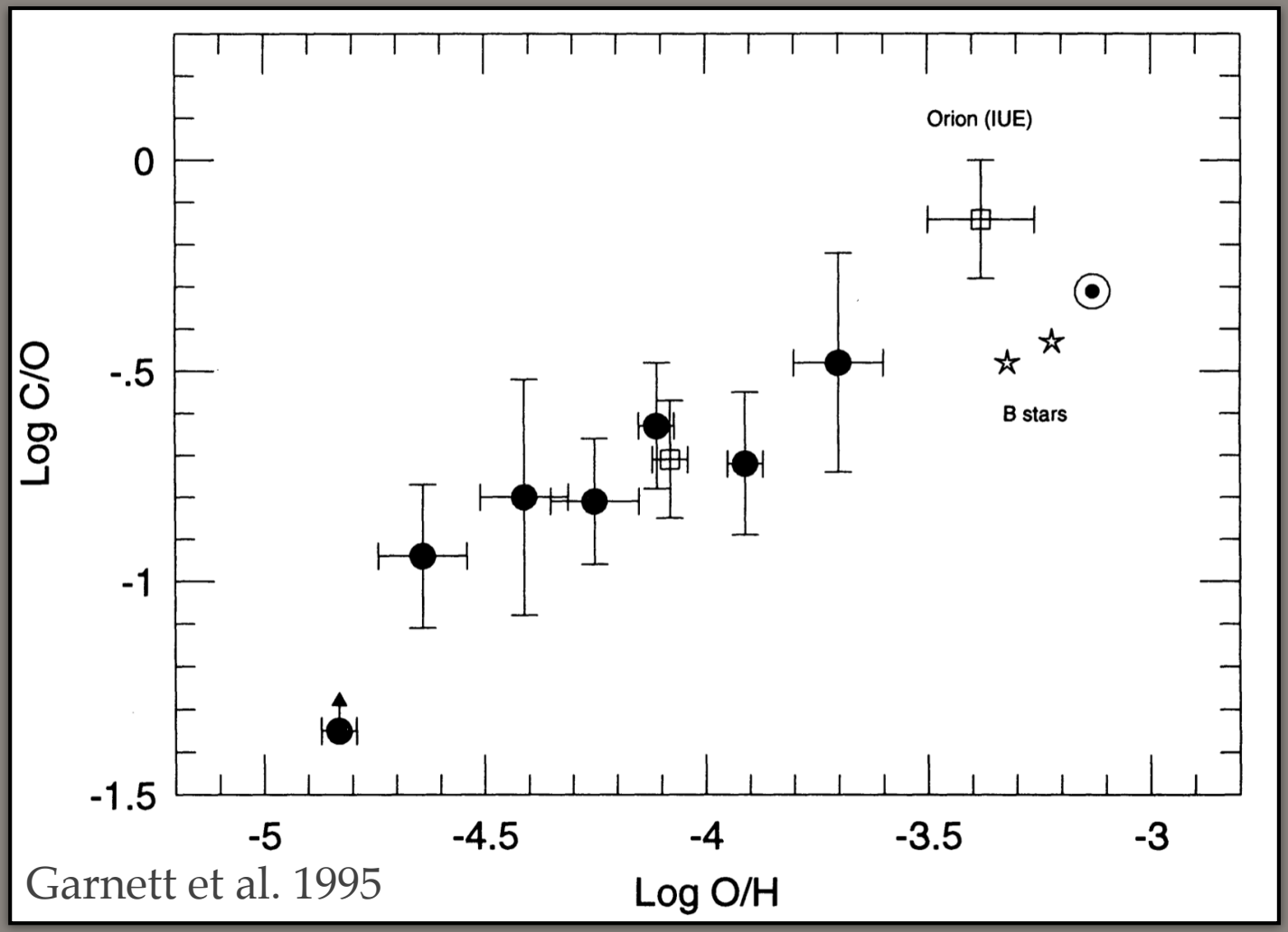
Interstellar Dust

Starburst Clock



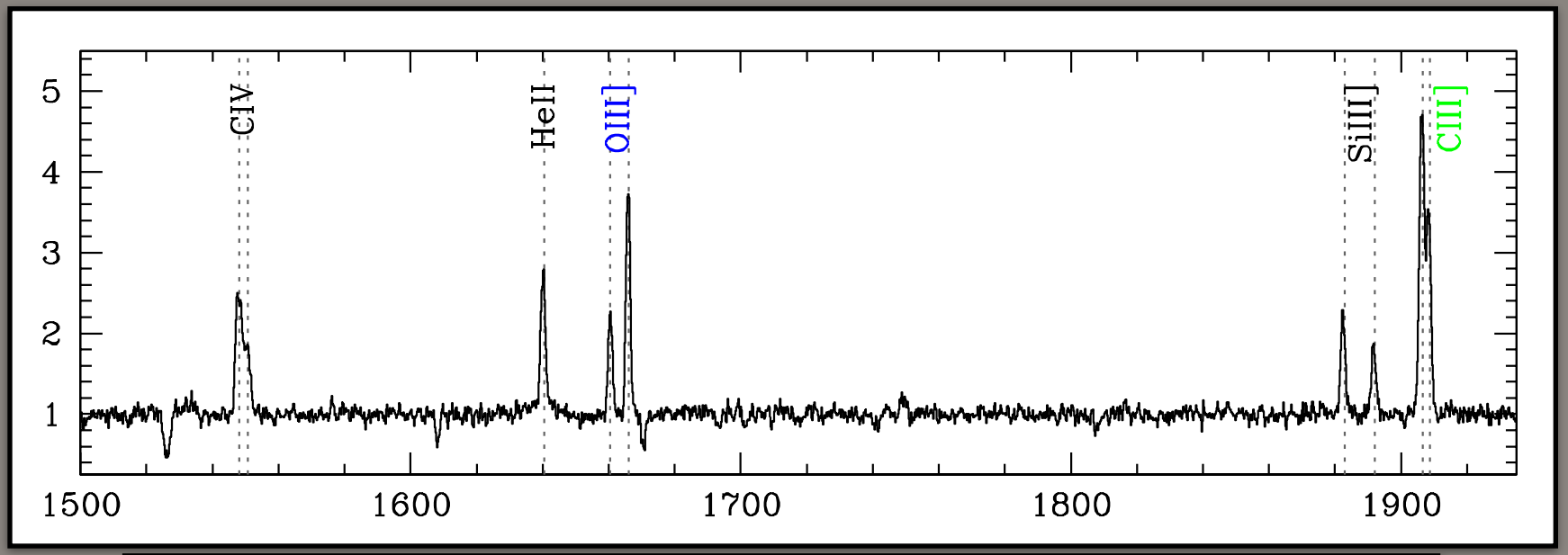
I. Previous C/O Studies

Understood increasing trend as secondary C production



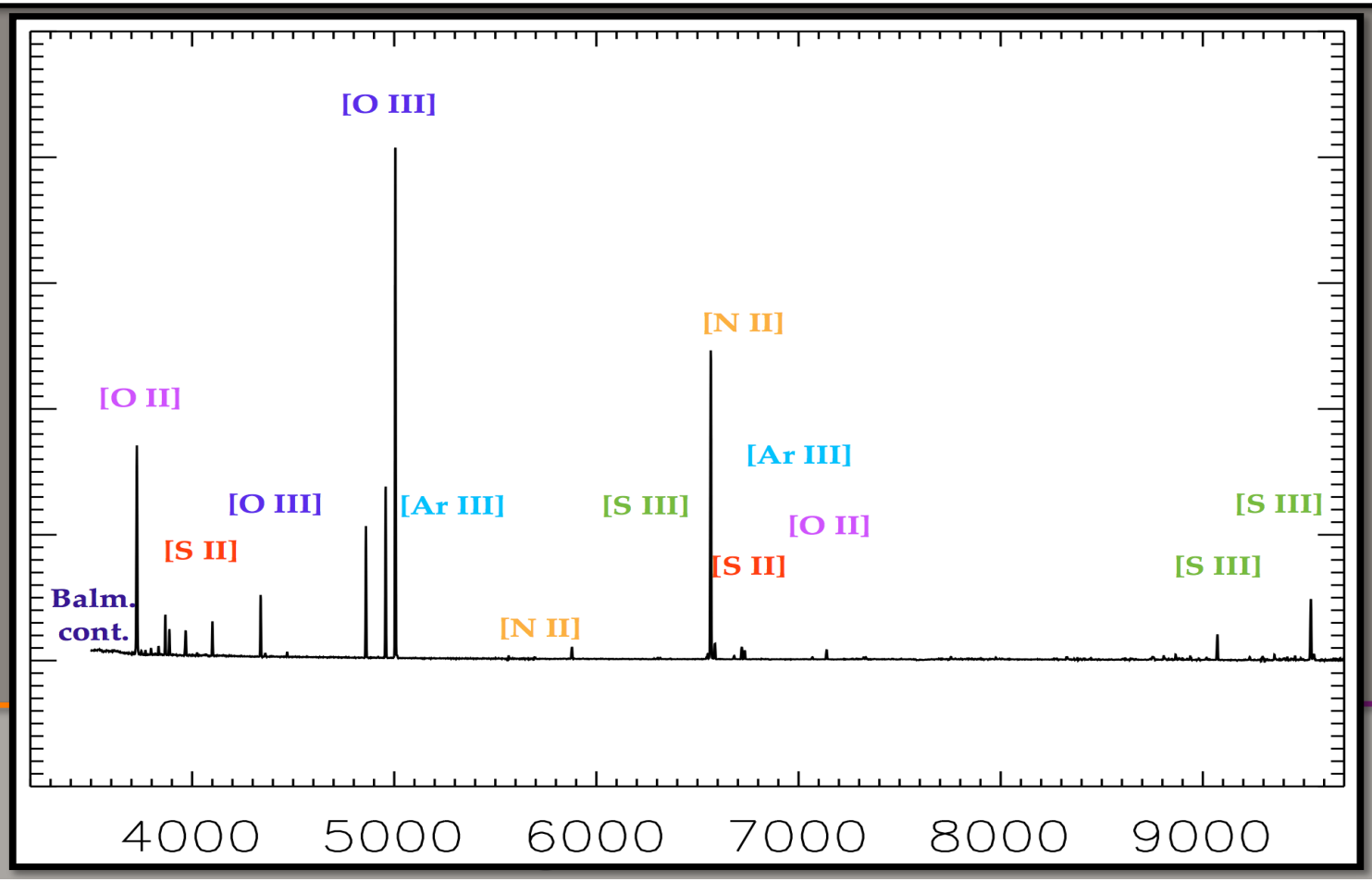
Garnett et al. 1995

II. C/O Best Method



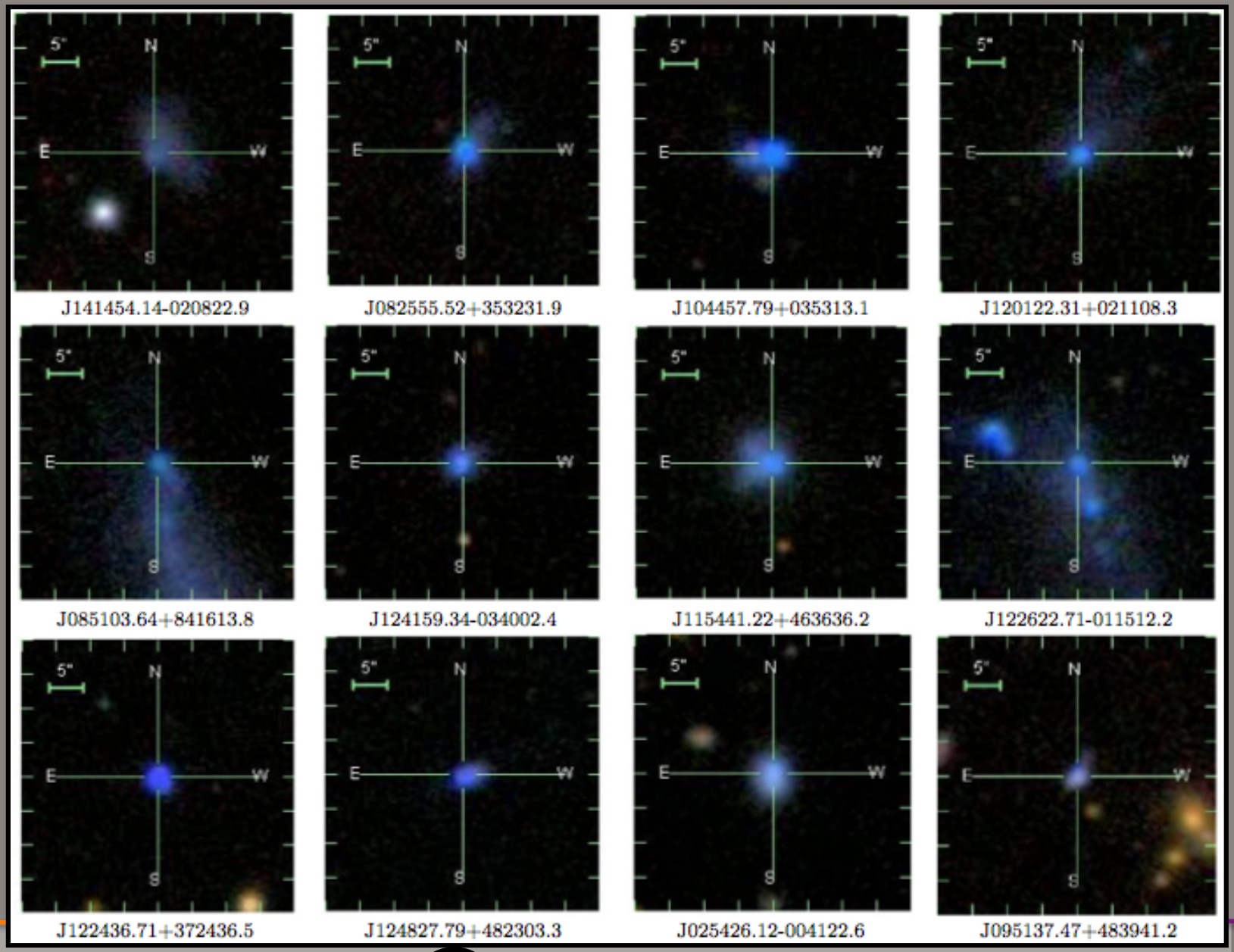
Simultaneous observations of C^{+2} and O^{+2} in the UV:

Avoid complications from combining UV and optical datasets



III. Sample Selection

1. $12+\log(O/H) \leq 8.2$
2. $z < 0.26$
3. $D_{25} < 5''$
4. $E(B\text{-}V) < 0.1$
5. $m_{FUV} < 19.5$
6. EW(5007) > 50
7. F(OIII]) S/N > 5



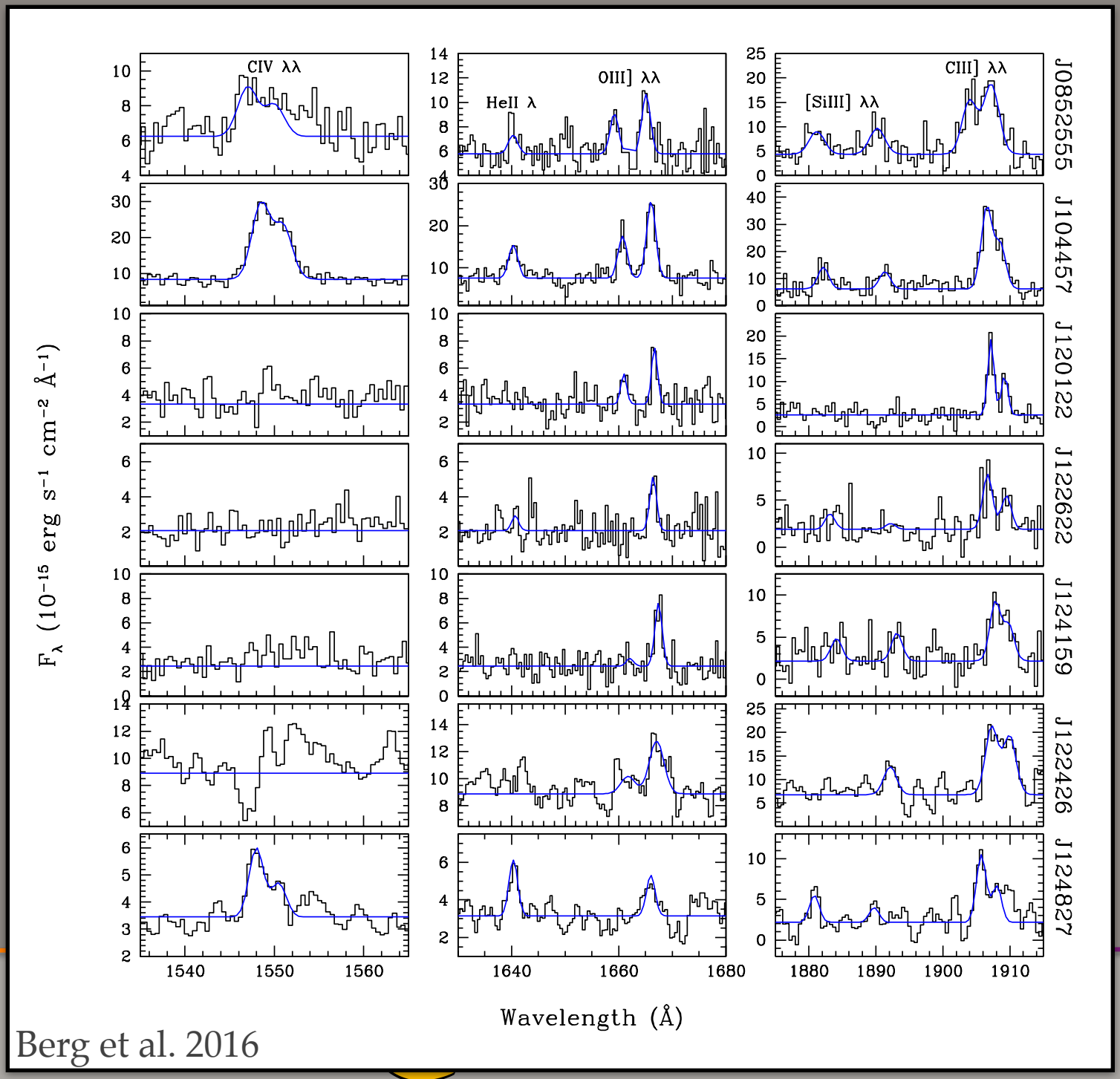
III. Sample Selection

Bright, Compact, Nearby Dwarf Sample

Target	R.A. (J2000)	Dec. (J2000)	z	M_B (mag)	log L_B ($L_\odot$)	log $M_\star$ ($M_\odot$)	log SFR ($M_\odot$/yr)	log sSFR (yr^{-1})	AB FUV (mag)	12+log(O/H) (dex)	t_{exp} (s)
J141454	14:14:54.14	-02:08:22.90	0.005	-13.4	7.57	6.61	-1.91	-8.58	19.32	7.28	4746
J082555	08:25:55.52	+35:32:31.9	0.003	-12.6	7.21	6.04	-1.98	-8.11	18.80	7.42	2180
J104457	10:44:57.79	+03:53:13.1	0.013	-15.9	8.56	6.80	-0.82	-7.82	18.28	7.44	2066
J120122	12:01:22.31	+02:11:08.3	0.003	-12.4	7.16	6.09	-1.97	-8.14	18.64	7.50	2056
J085103	08:51:03.64	+84:16:13.8	0.006	-9.6	6.03	6.08	-2.30	-8.46	17.01	7.66	2154
J124159	12:41:59.34	-03:40:02.4	0.009	-14.5	7.97	6.59	-1.40	-8.05	19.44	7.74	1847
J115441	11:54:41.22	+46:36:36.2	0.004	-13.8	7.71	6.14	-2.02	-8.22	17.98	7.75	2229
J122622	12:26:22.71	-01:15:12.2	0.007	-12.4	7.15	7.21	-1.10	-8.37	17.67	7.77	1944
J122436	12:24:36.71	+37:24:36.5	0.040	-18.0	9.41	7.86	-0.06	-8.01	18.41	7.78	2136
J124827	12:48:27.79	+48:23:03.3	0.030	...	...	7.47	-0.49	-8.05	19.44	7.80	2044
J025426	02:54:26.12	-00:41:22.6	0.015	-16.4	8.77	7.65	-0.67	-8.40	18.54	8.06	2048
J095137	09:51:37.47	+48:39:41.2	0.135	-14.8	8.13	9.34	0.49	-8.93	19.10	8.20	2168

IV. Observations

HST COS G140L grating allows OIII] and CIII] to be observed simultaneously for nearby targets



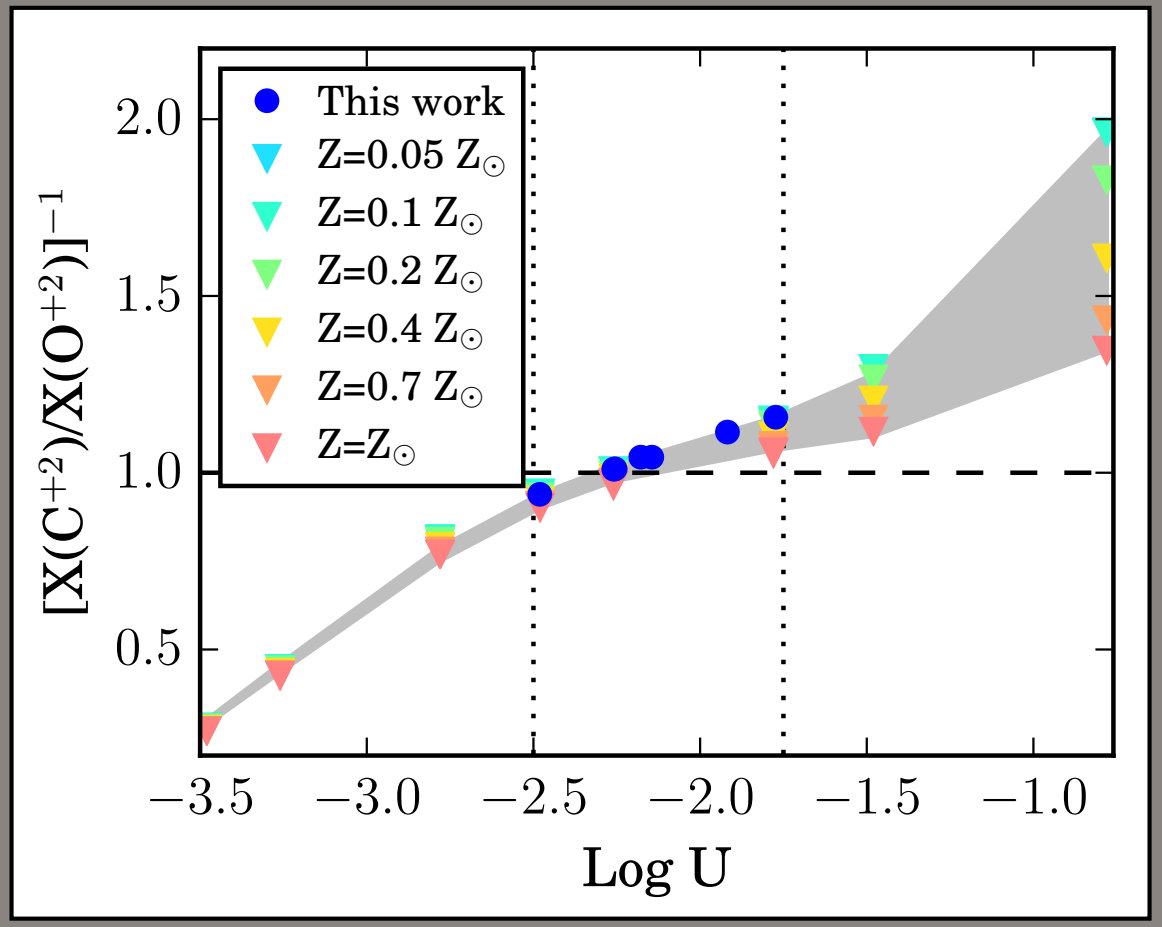
Berg et al. 2016

V. C/O vs O/H Abundance Determinations

O/H - 3σ [OIII] λ4363
- significant differences
from OIII] λ1666

UV - OIII] λ1666 & CIII]
λλ1907,1909

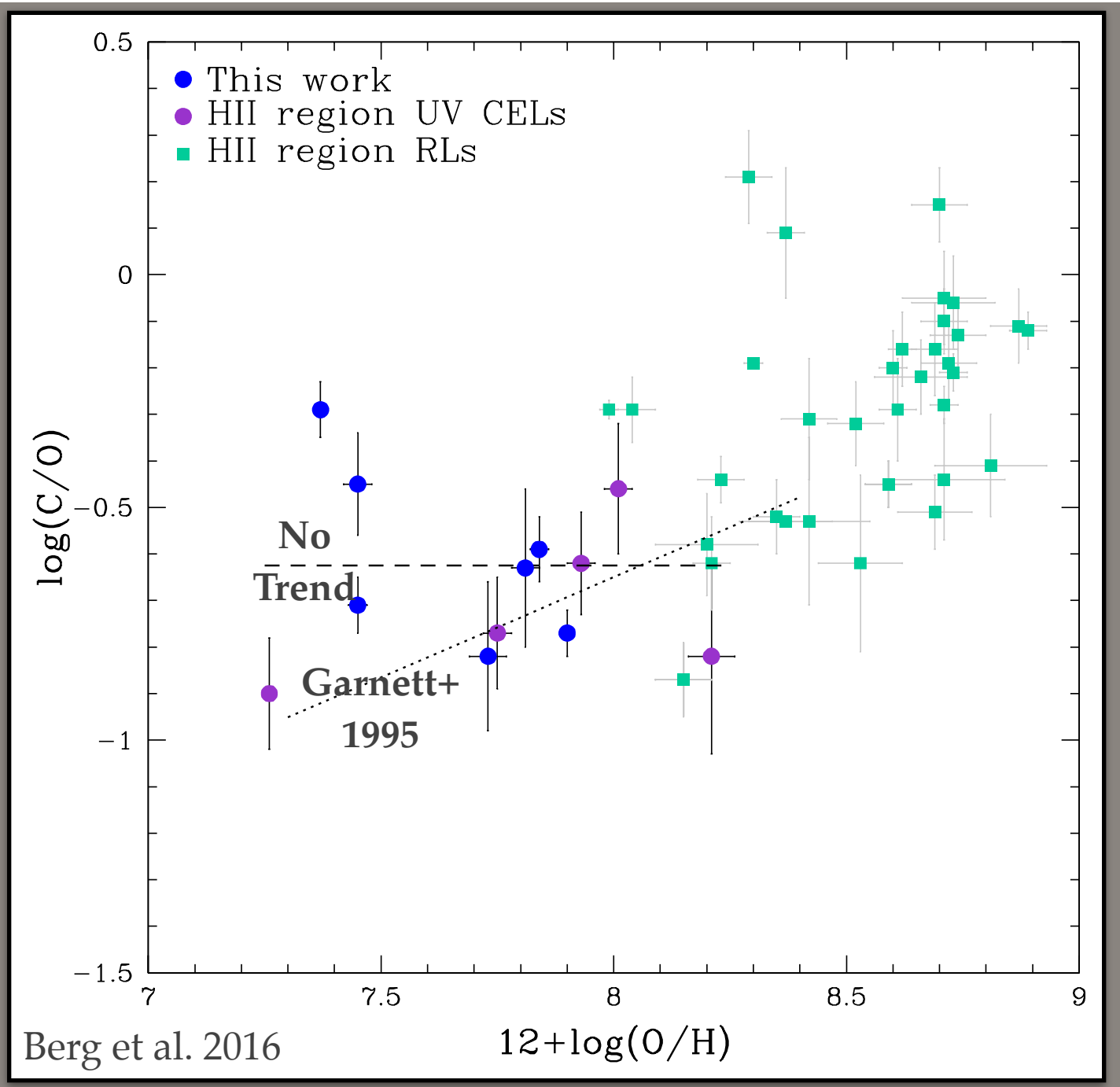
CIV detections imply
ICF is important



VI. C/O Abundances: Nearby HII Regions

i. UV C/O abundance relationship is more scattered than found previously:

1. Flat + scatter
2. Increasing + outliers



Berg et al. 2016

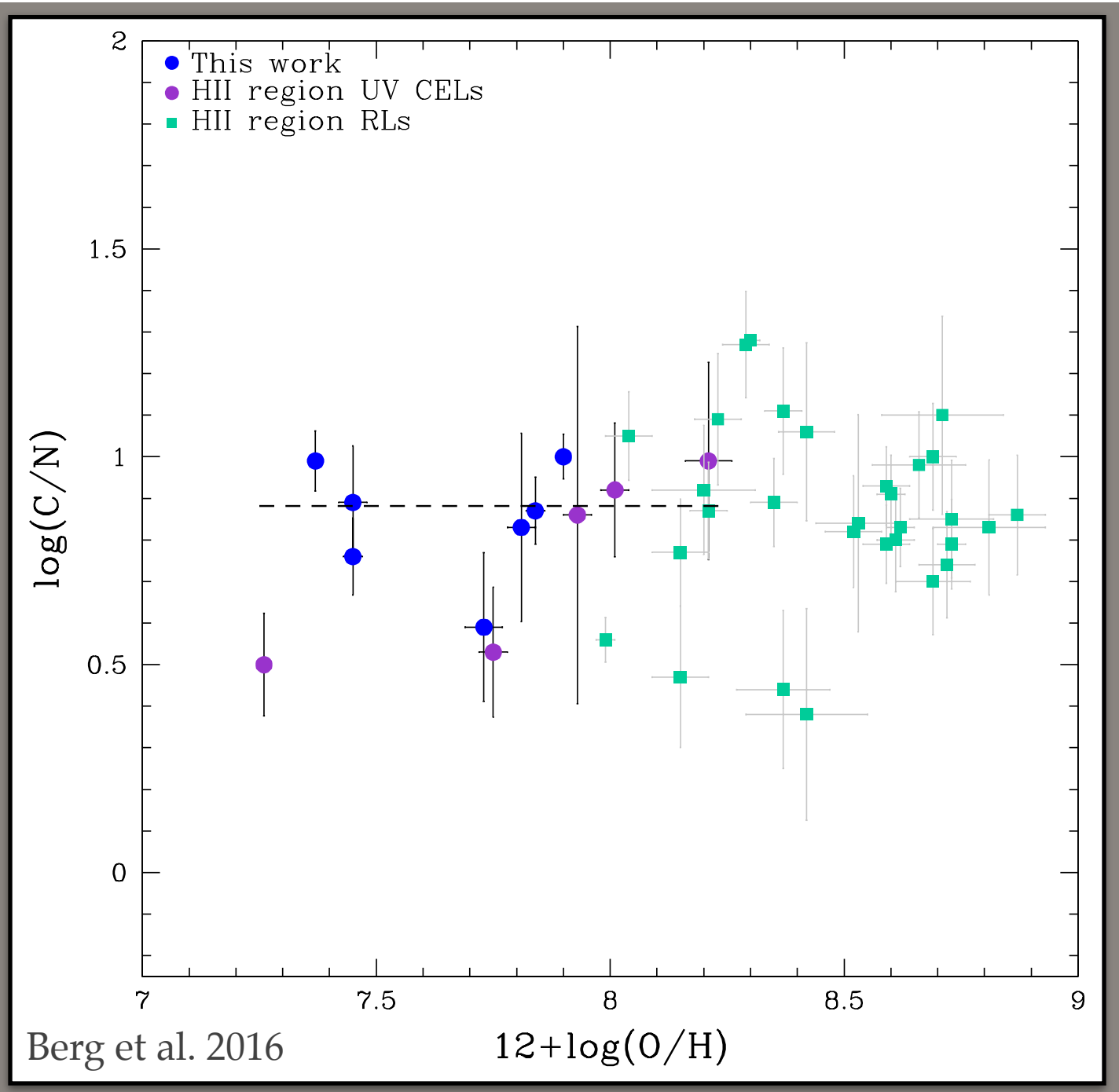
RLs: Esteban+ 2002
Peimbert+ 2005
García-Rojas & Estaban 2007
López-Sánchez+ 2007
Esteban+ 2009
Esteban+ 2014

CELs: Dufour+ 1982
Garnett+ 1995
Kurt+ 1999

VI. C/O Abundances: Nearby HII Regions

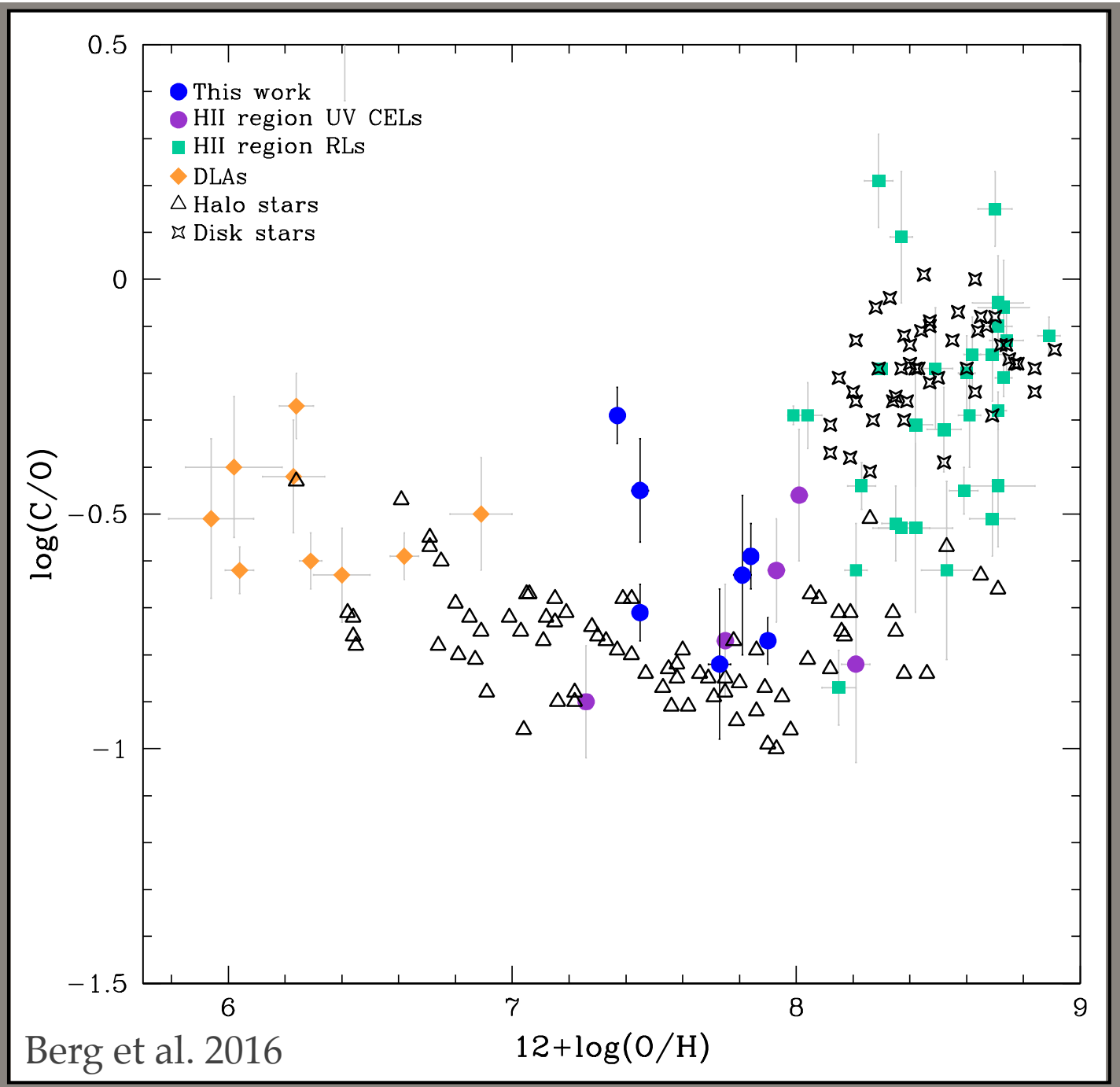
ii. C/N relationship flat with large scatter:

1. N/O is bimodal
2. C/O may follow similar pattern



Berg et al. 2016

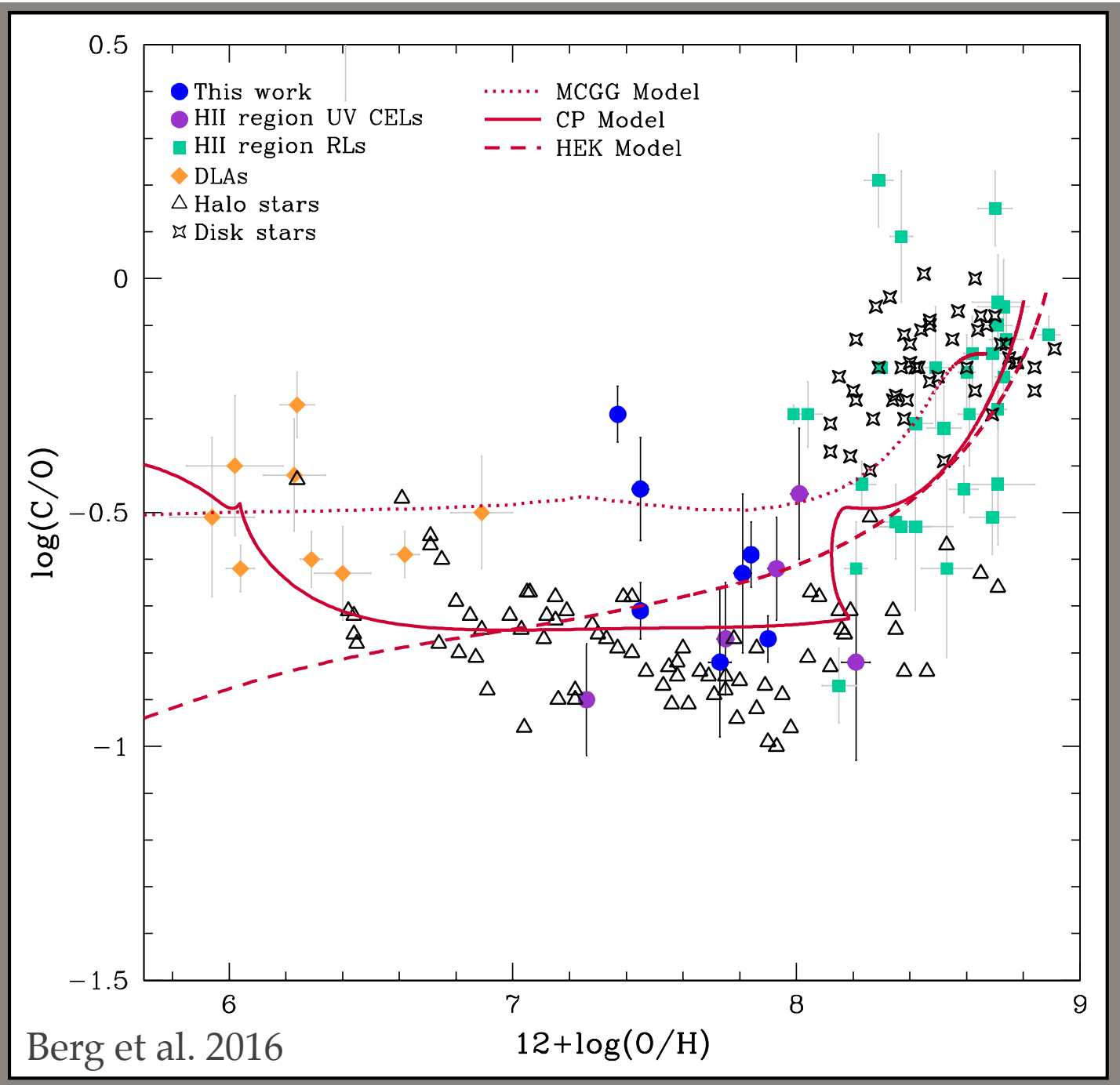
VII. C/O Abundances: From Stars and DLAs



Disk Stars: Gustafsson+ 1999
Halo Stars: Akerman+2004
Fabbian+ 2009

DLAs: Cooke+ 2011

VIII. C/O Abundances: Chemical Evolution Models



MCGG = Mólla+ 2015
CP = Carigi & Peimbert 2011
HEK = Henry+ 2000

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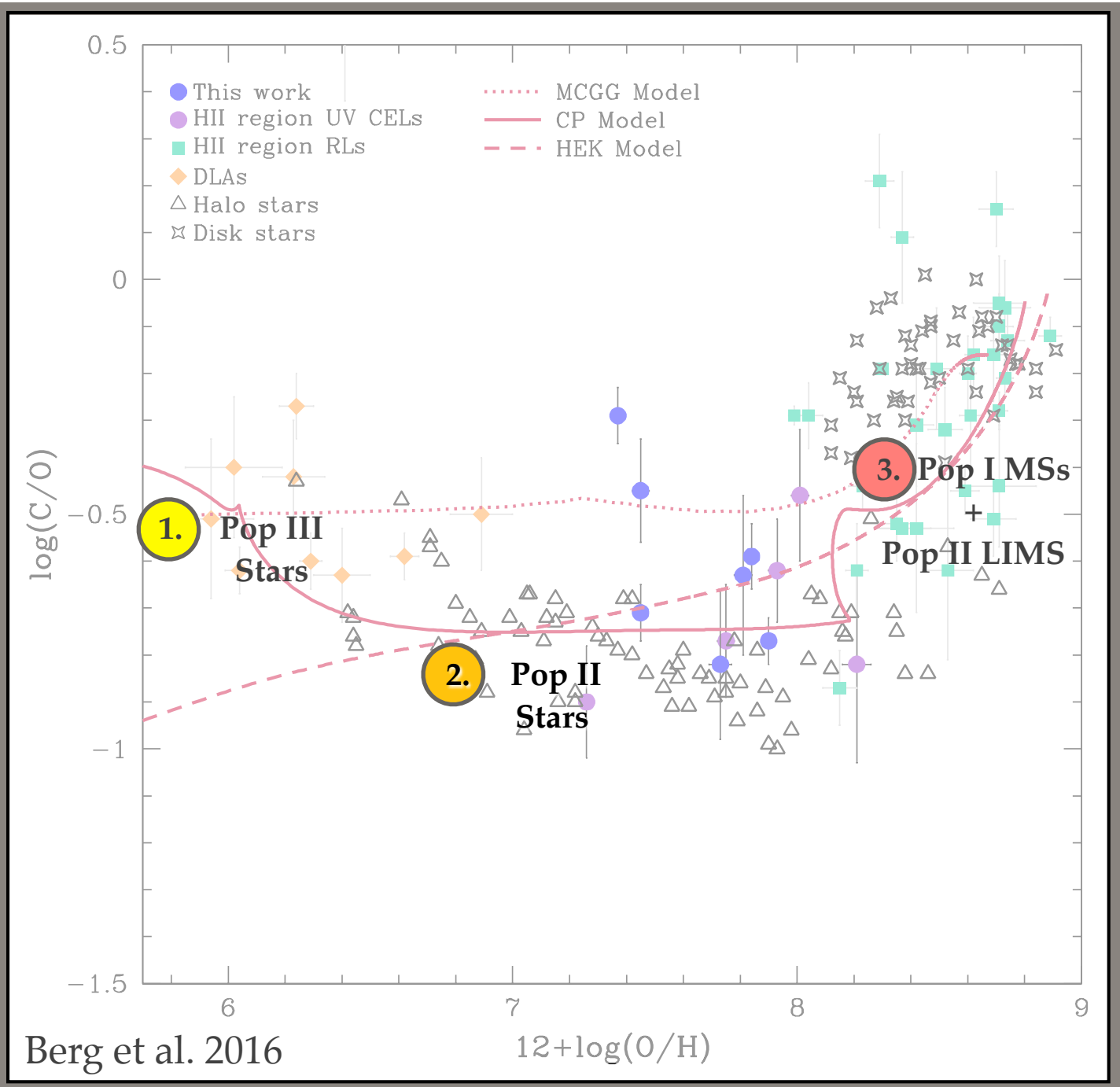

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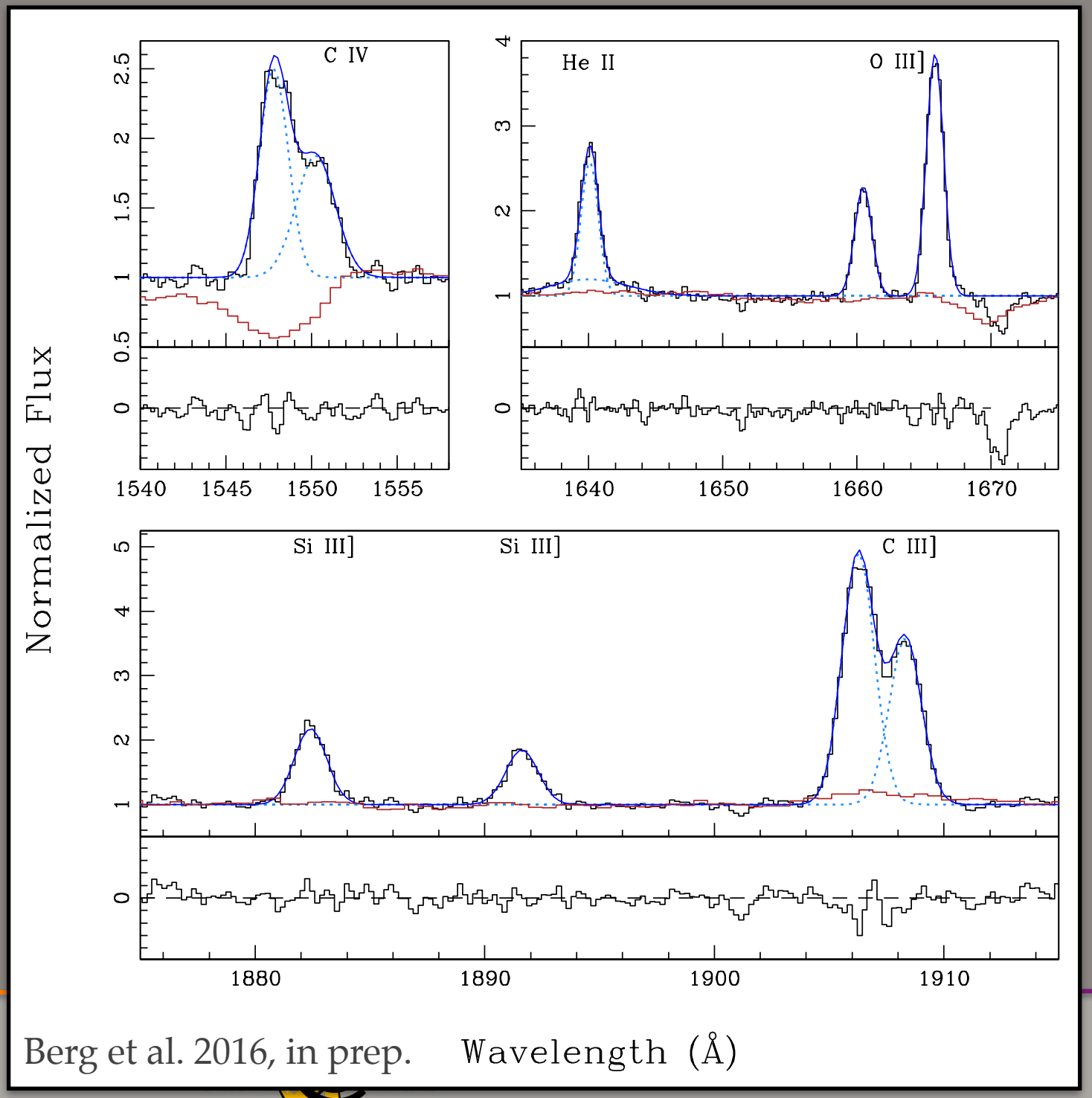
IX. C/O Abundances: From High Redshift Galaxies

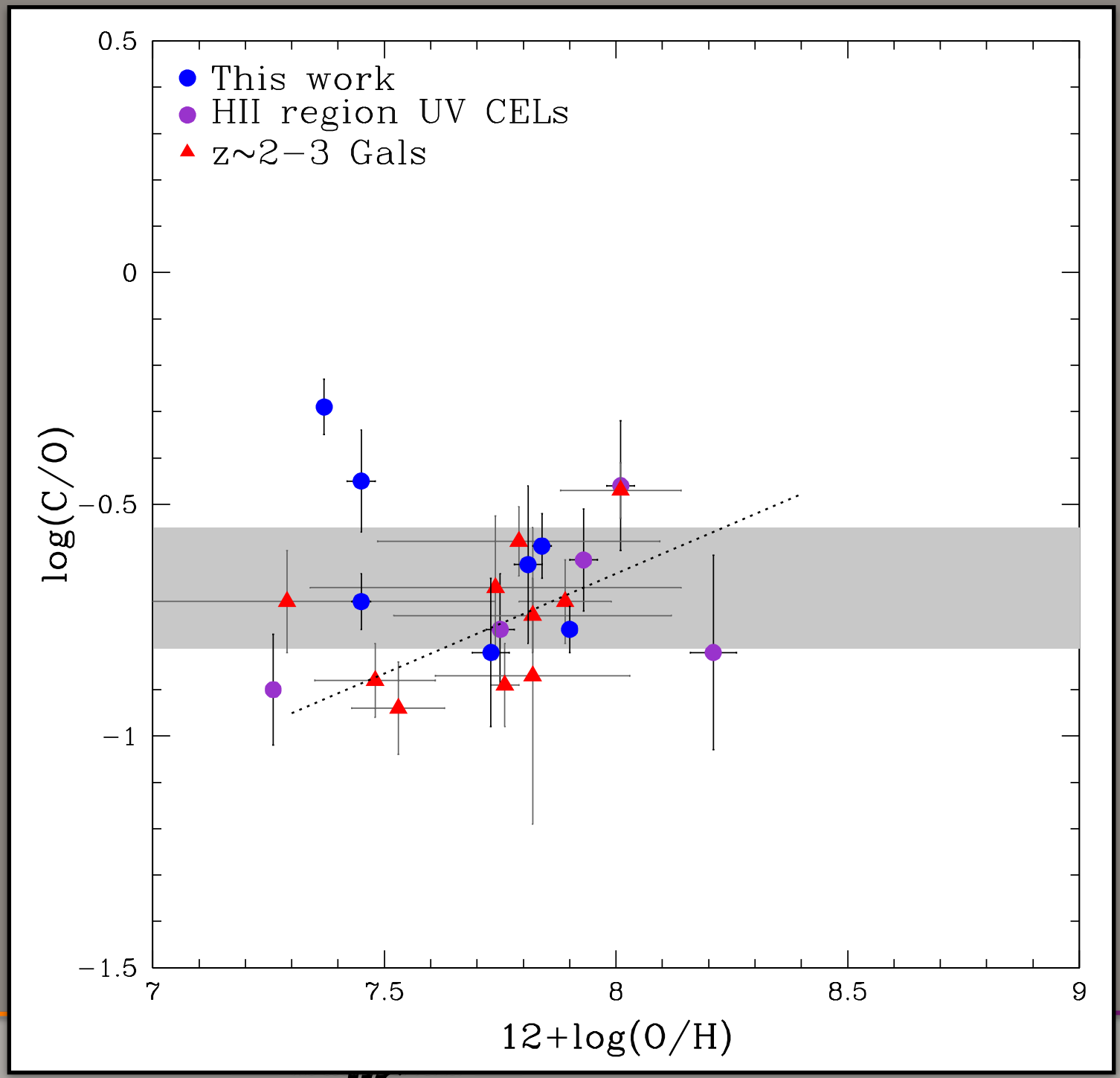
SL2S is extremely high ionization and excitation and allows a direct metallicity measurement



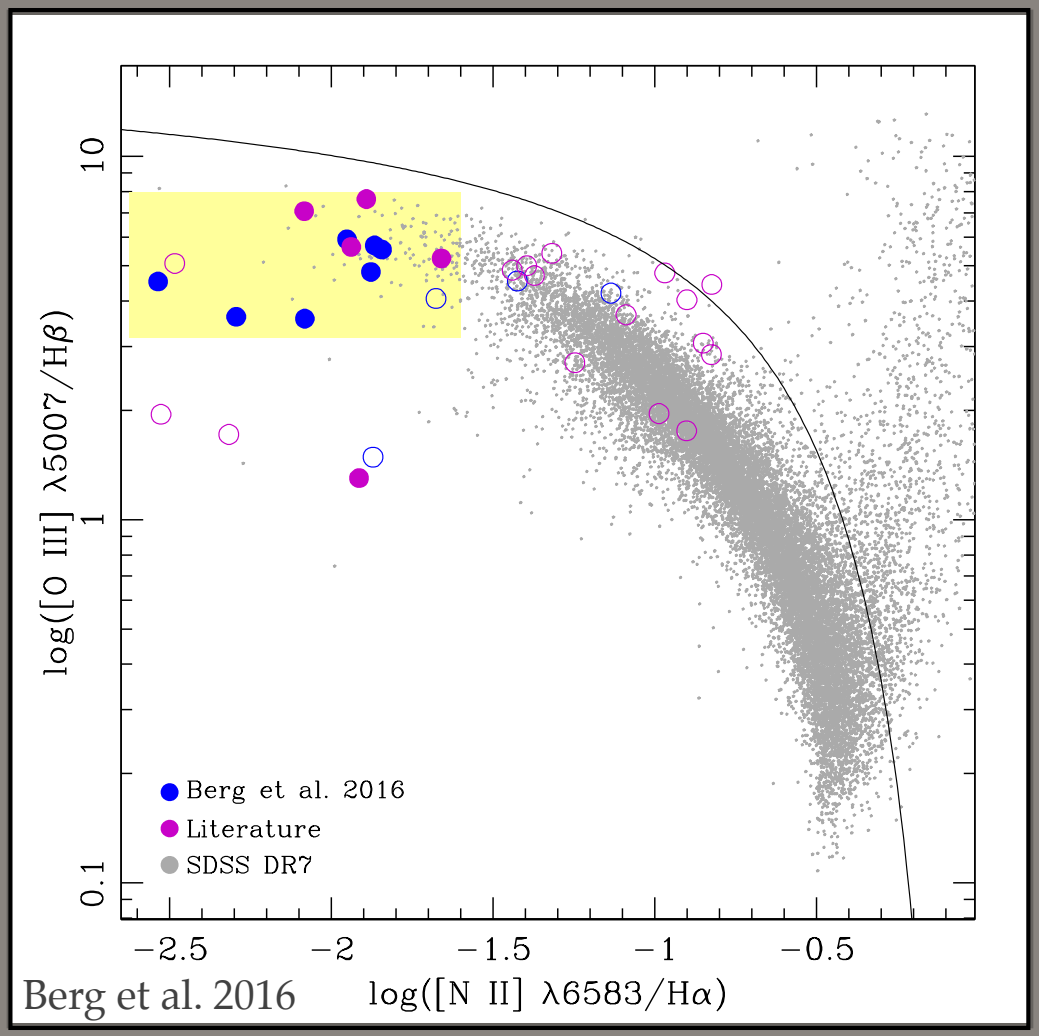
Berg et al. 2016, in prep.

IX. C/O Abundances: From High Redshift Galaxies

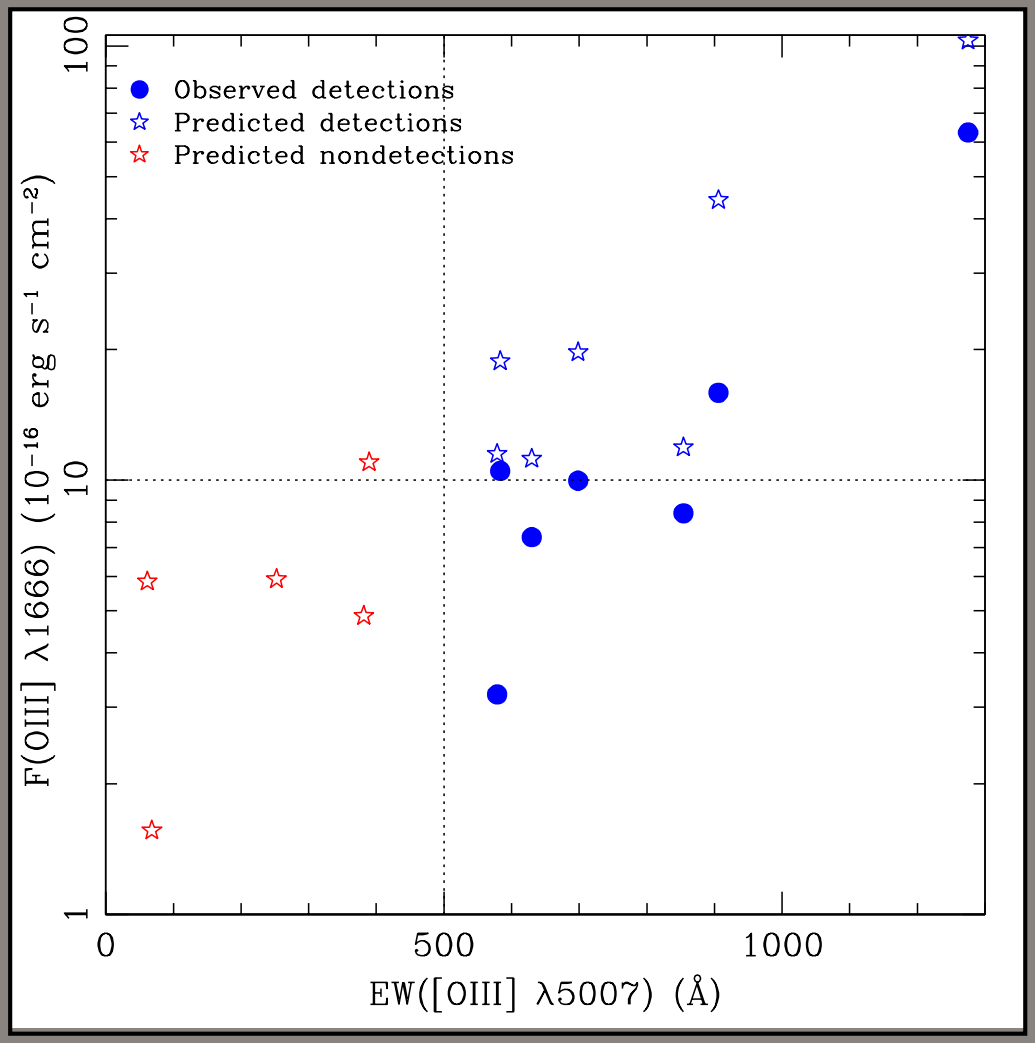
Shapley+ 2003
Erb+ 2010
Christensen+ 2012
James+ 2014
Stark+ 2014
Bayliss+ 2014
Berg+ 2016, in prep



X. Selecting targets for future UV C/O detections



Berg et al. 2016



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