

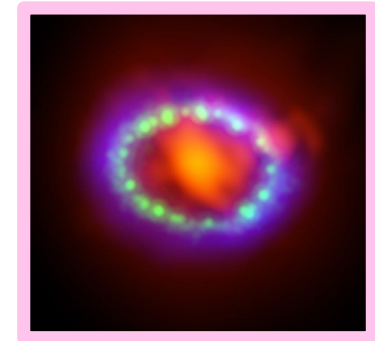
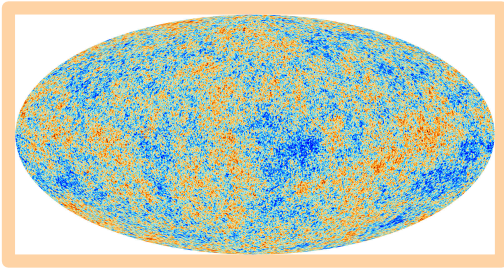


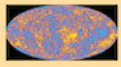





Inner Galaxy Abundance Patterns *with APOGEE DR15*

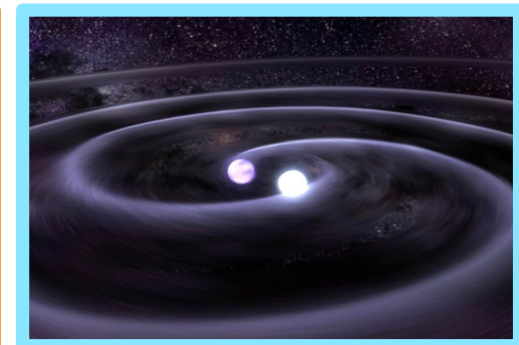
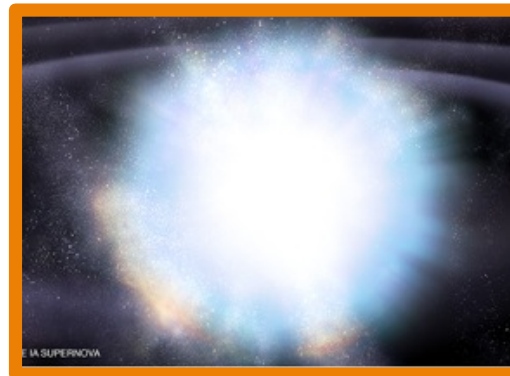
Gail Zasowski
University of Utah



APOGEE in the Inner Galaxy

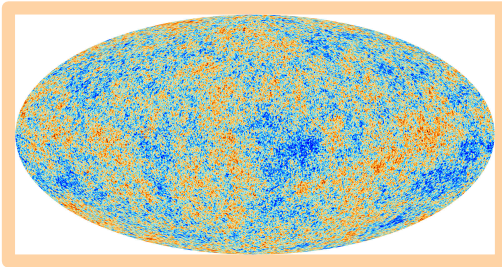


1 H	big bang fusion 										cosmic ray fission 					2 He						
3 Li	4 Be	merging neutron stars 										exploding massive stars 					5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg	dying low mass stars 										exploding white dwarfs 					13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr					
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe					
55 Cs	56 Ba		72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn					
87 Fr	88 Ra																					

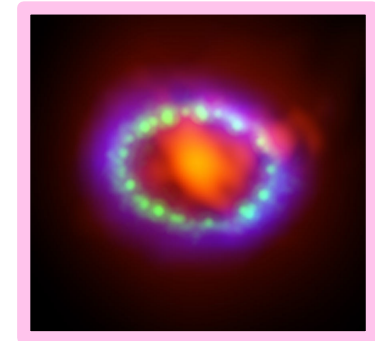


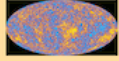





Graphic: Jennifer Johnson
Astro Images: ESA/NASA/AASNova

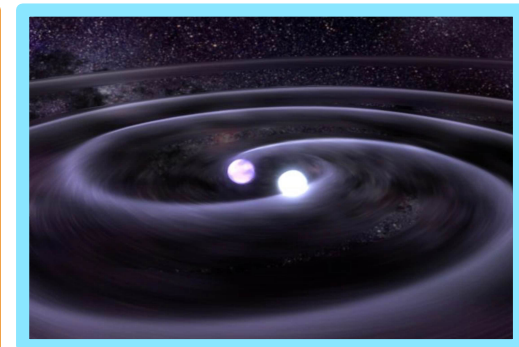
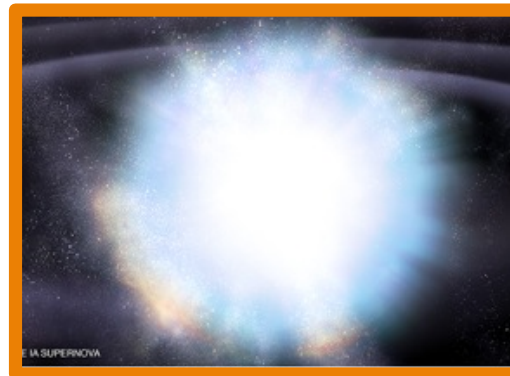
APOGEE in the Inner Galaxy



Elements derived by APOGEE
(plus Yb, Nd, and Ce)

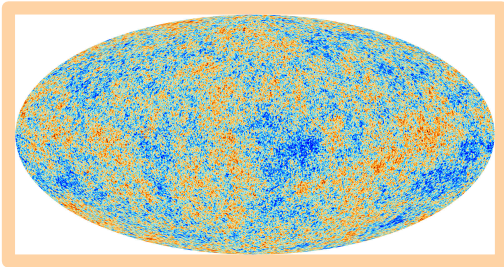


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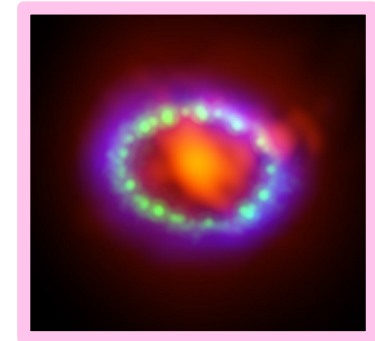


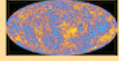





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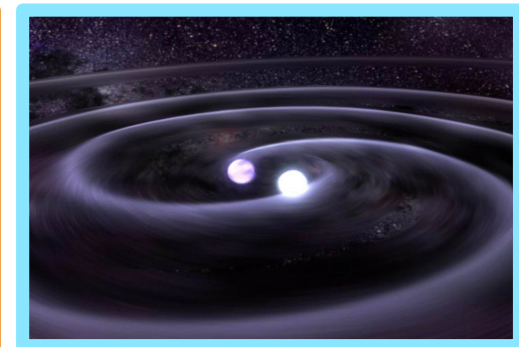
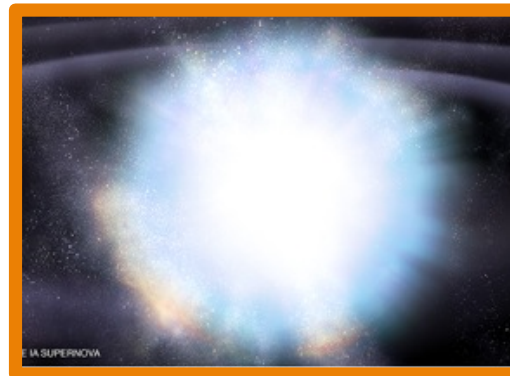
APOGEE in the Inner Galaxy



Elements used in this work



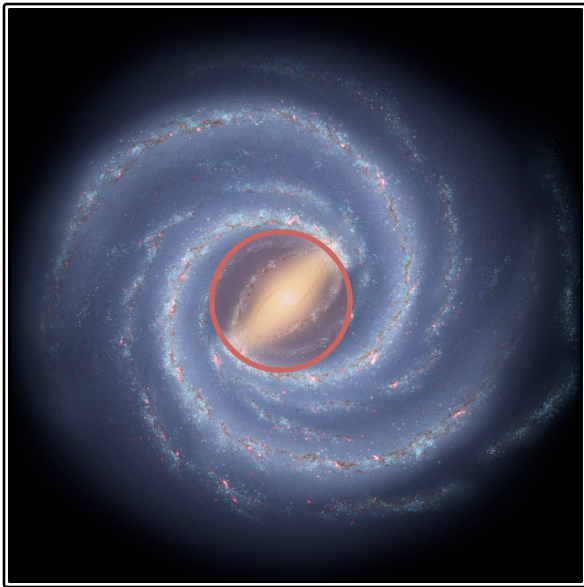
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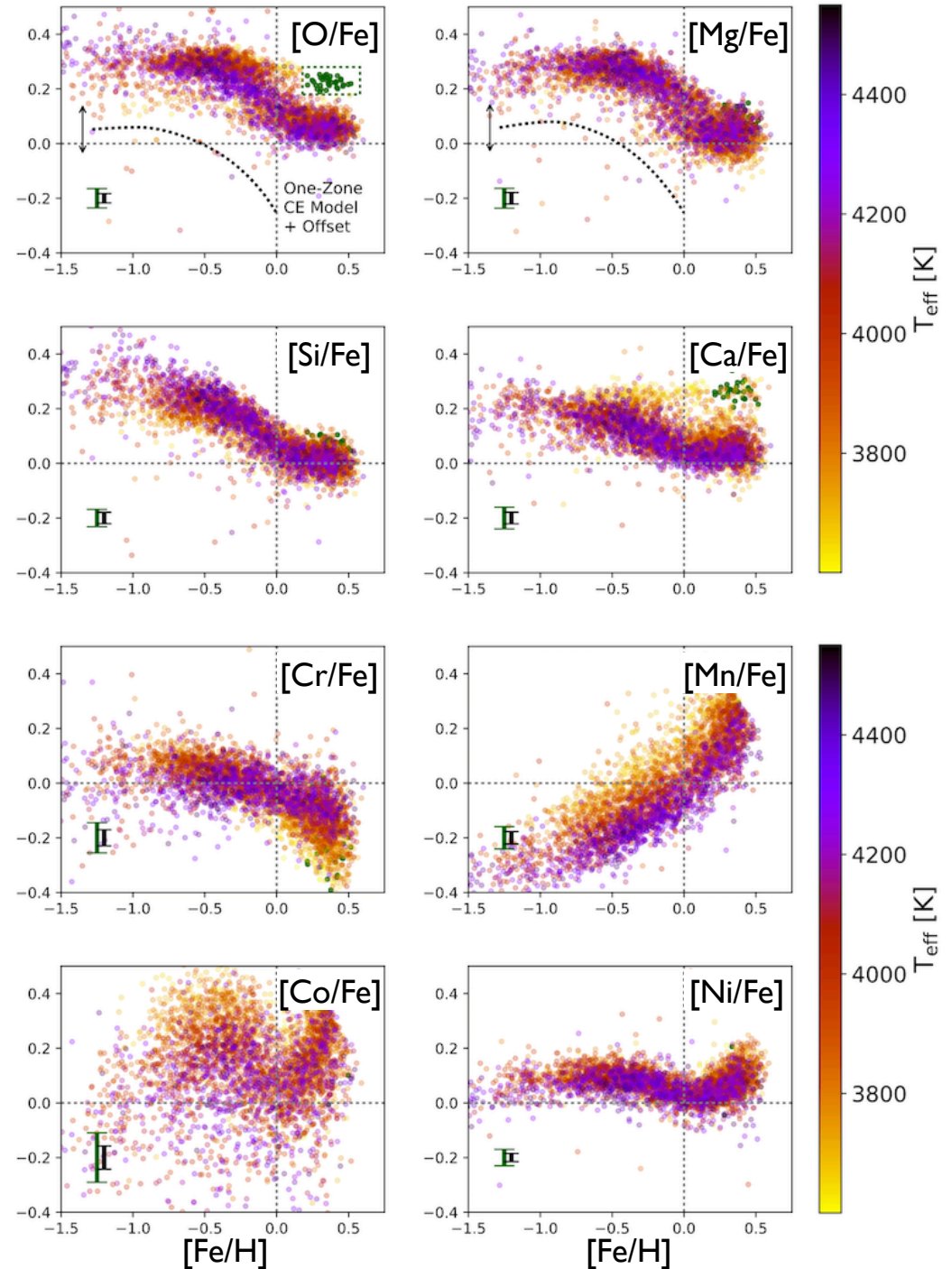
Graphic: Jennifer Johnson
Astro Images: ESA/NASA/AASNova

Abundance Distributions

- Alpha elements highlight simple chemical evolutionary track
- Data caveats for users to be aware of (some trends robust to these)

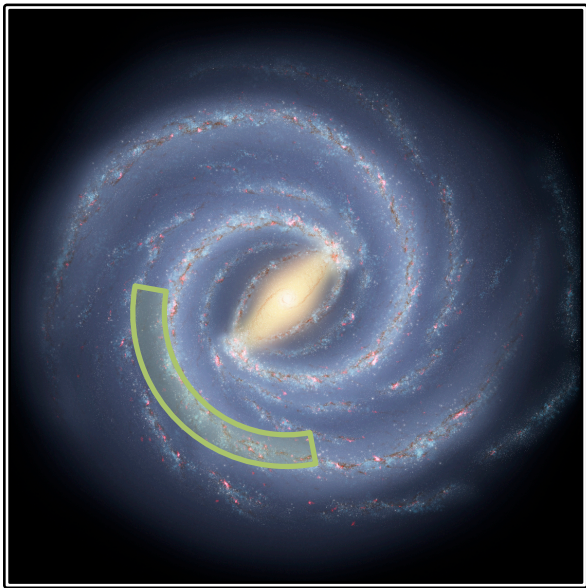


Zasowski et al. (2019, *ApJ*, 1811.01097)

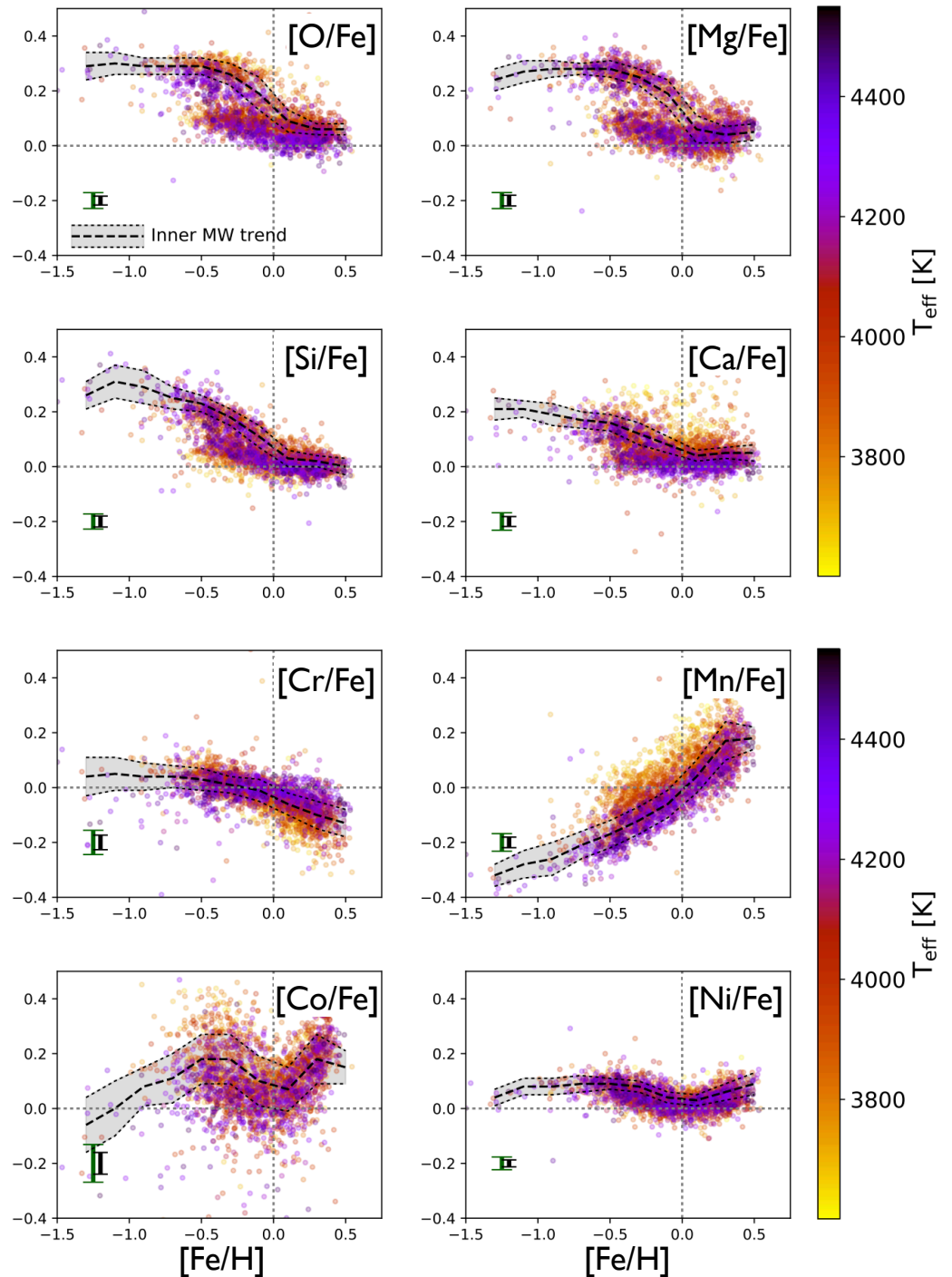


Comparison to Solar Radius

- Sample matched in T_{eff} , $[M/H]$, and high in SNR
- Visually similar in some elements (non-alphas); dissimilar in others (alphas)



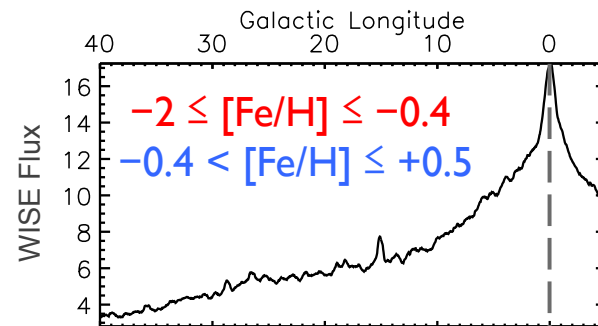
Zasowski et al. (2019)



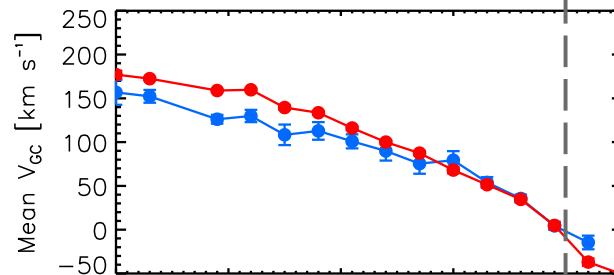
Mean $[M/H]$ (or $[\alpha/Fe]$) & Dynamics



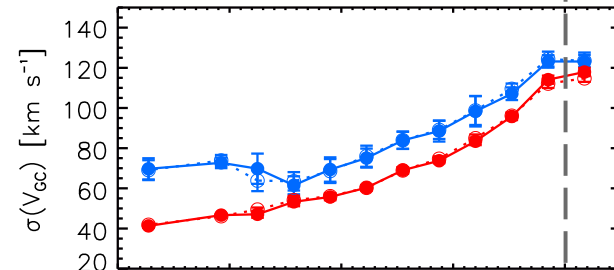
Surface
Brightness



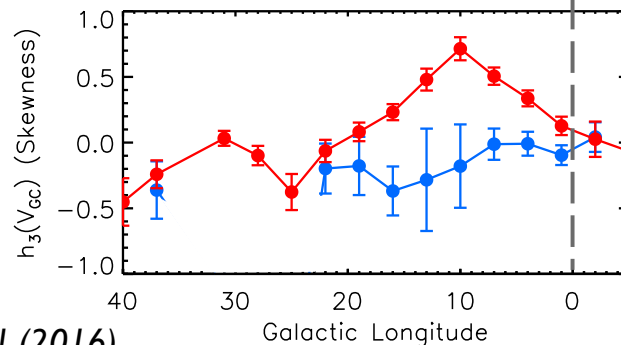
Radial
Velocity



Velocity
Dispersion

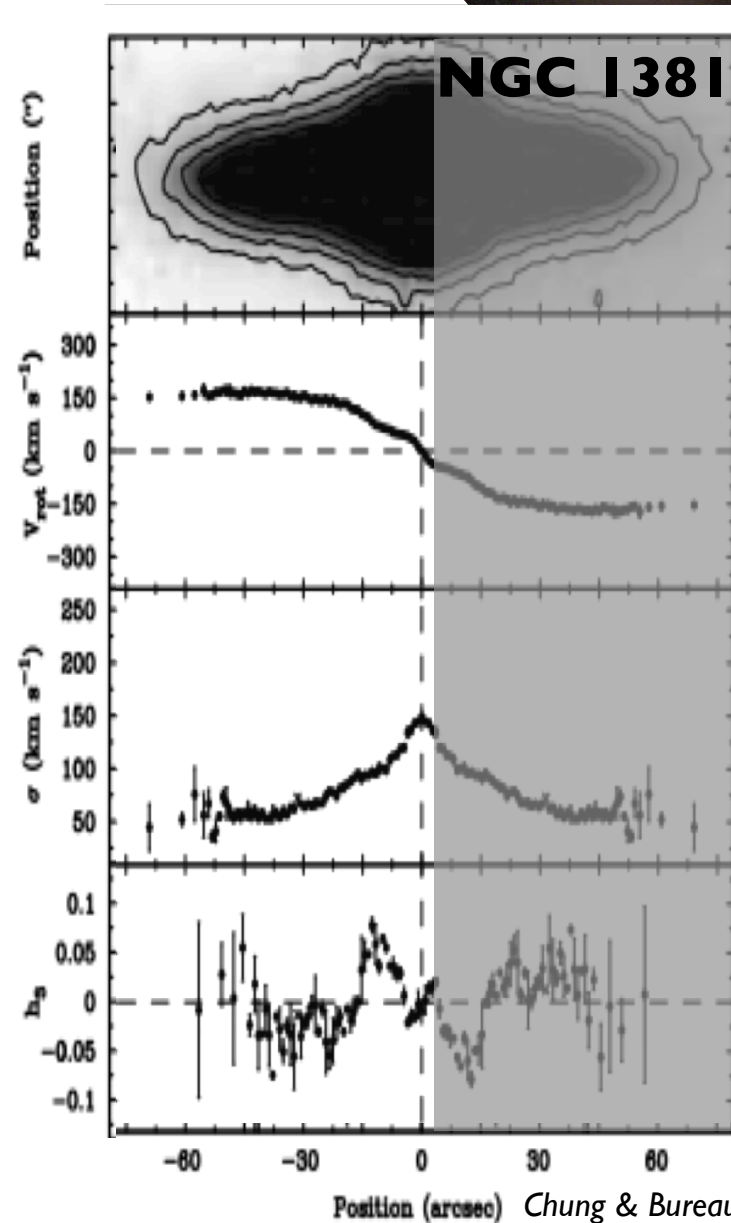


Velocity
Skewness



Ness et al. (2016), GZ et al. (2016)

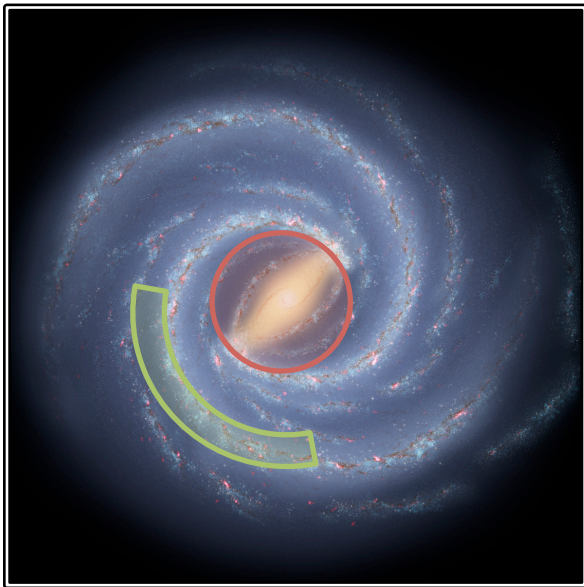
NGC 1381



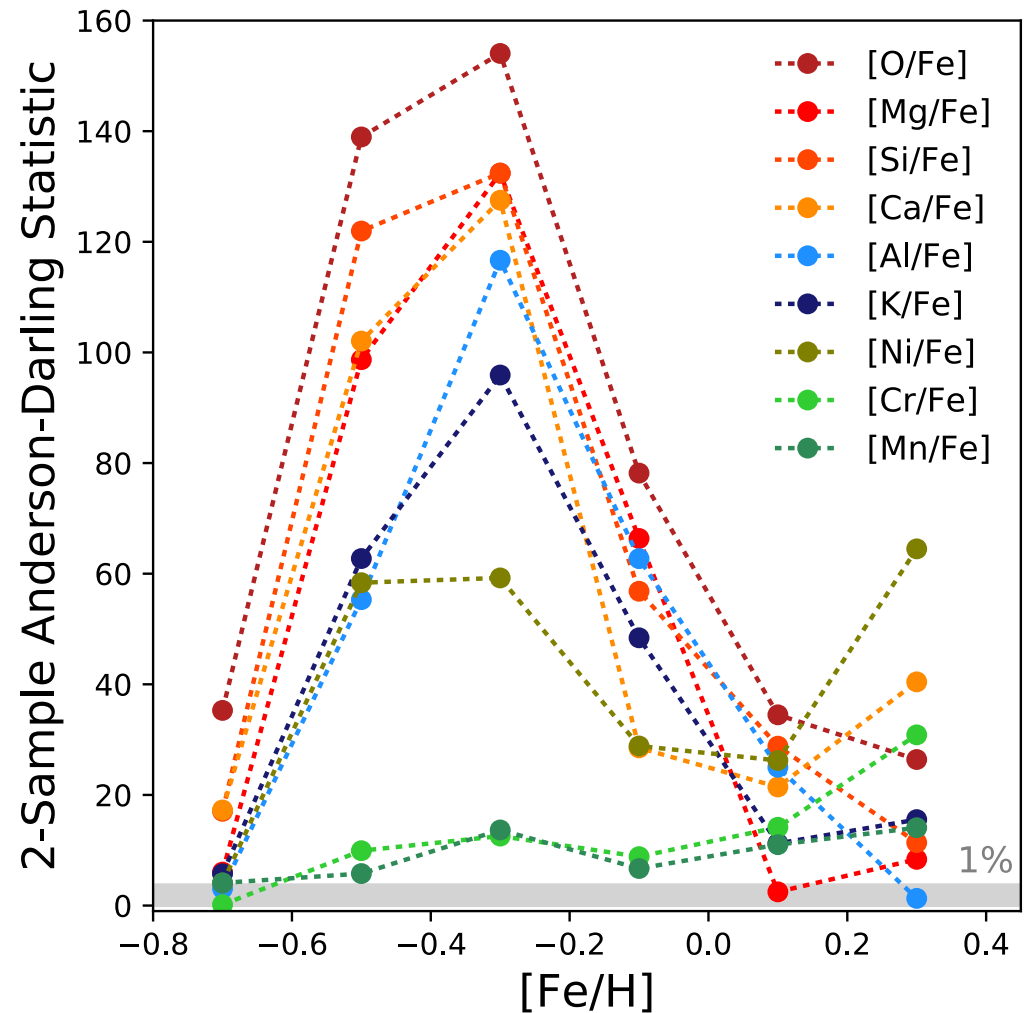
Position (arcsec) Chung & Bureau (2004)

Comparison to Solar Neighborhood

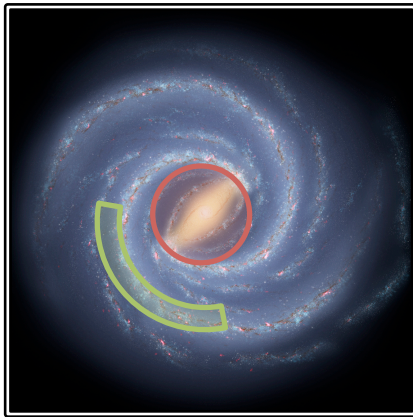
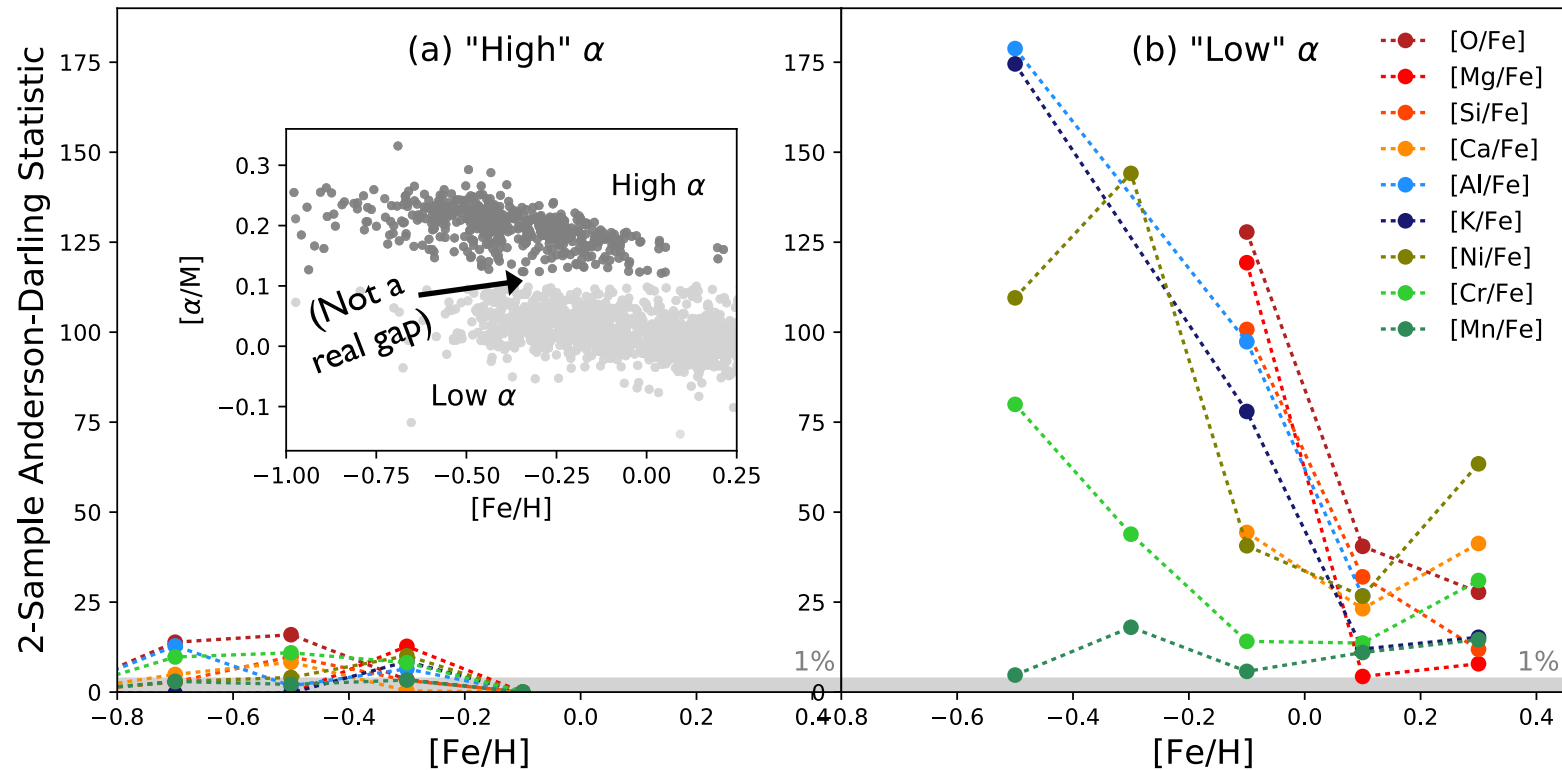
- Quantitative estimate of (dis)similarity
- Strongest in alpha elements and others with large CCSNe contributions



Zasowski et al. (2019)

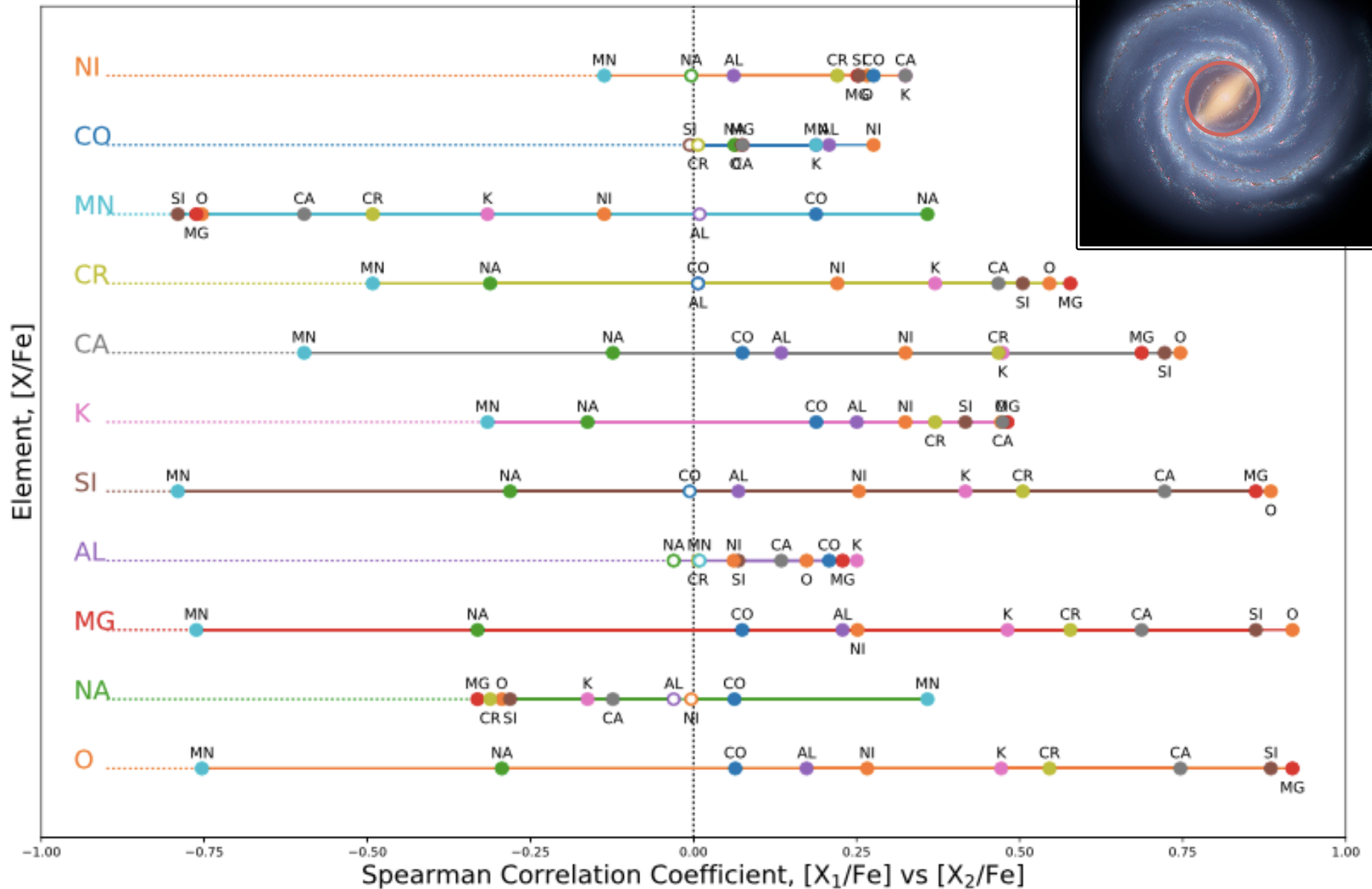
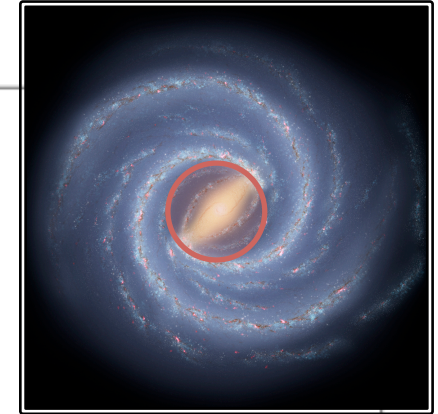


Comparison to Solar Neighborhood

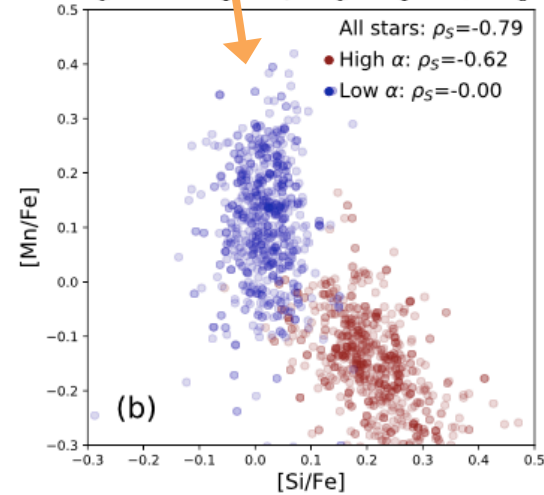
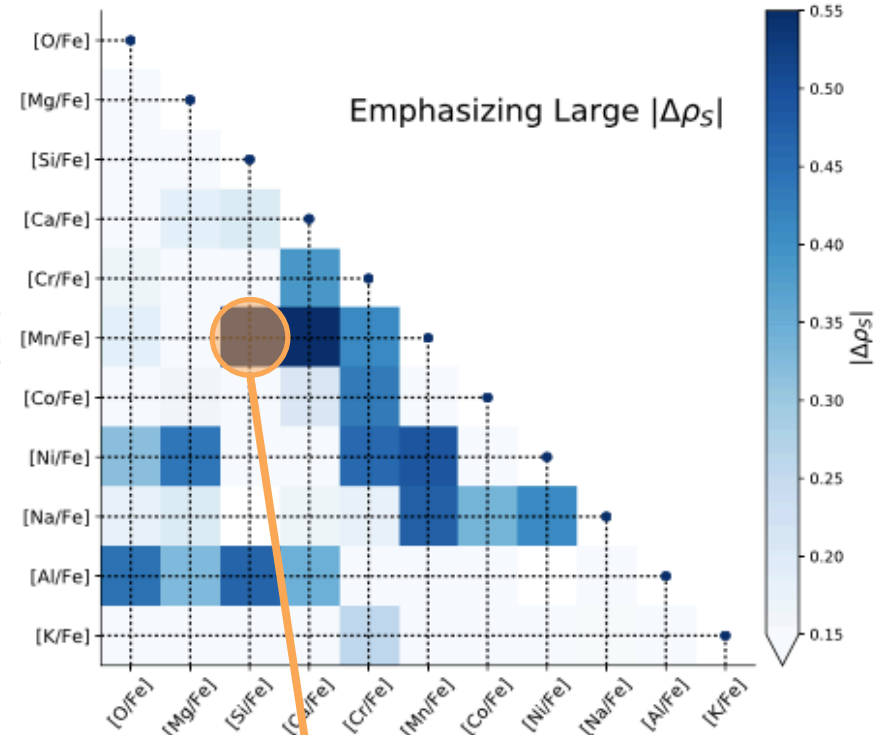
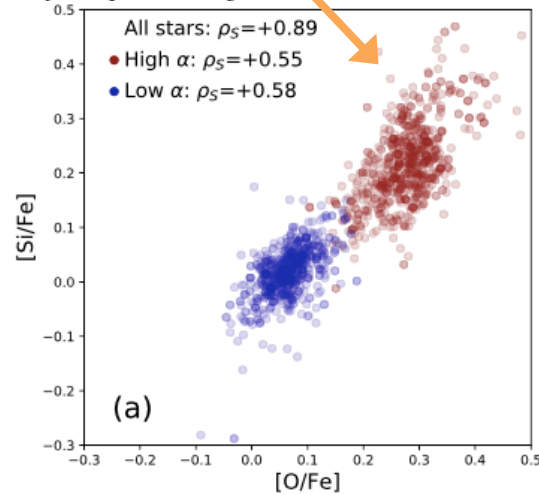
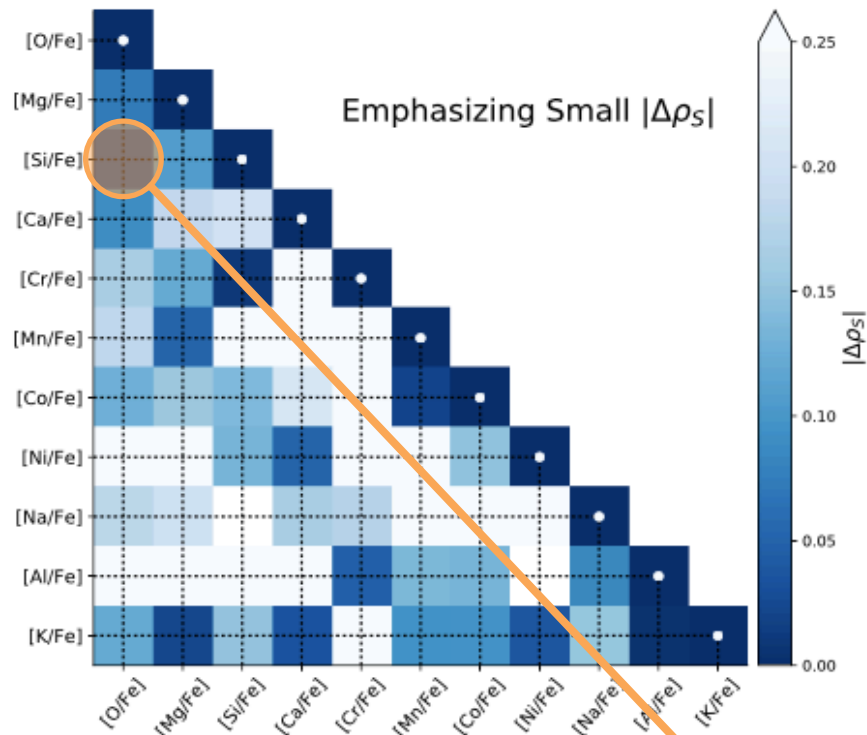


- Small differences even for nearby chemical thick disk
- Examples of metrics useful for model/data comparison!

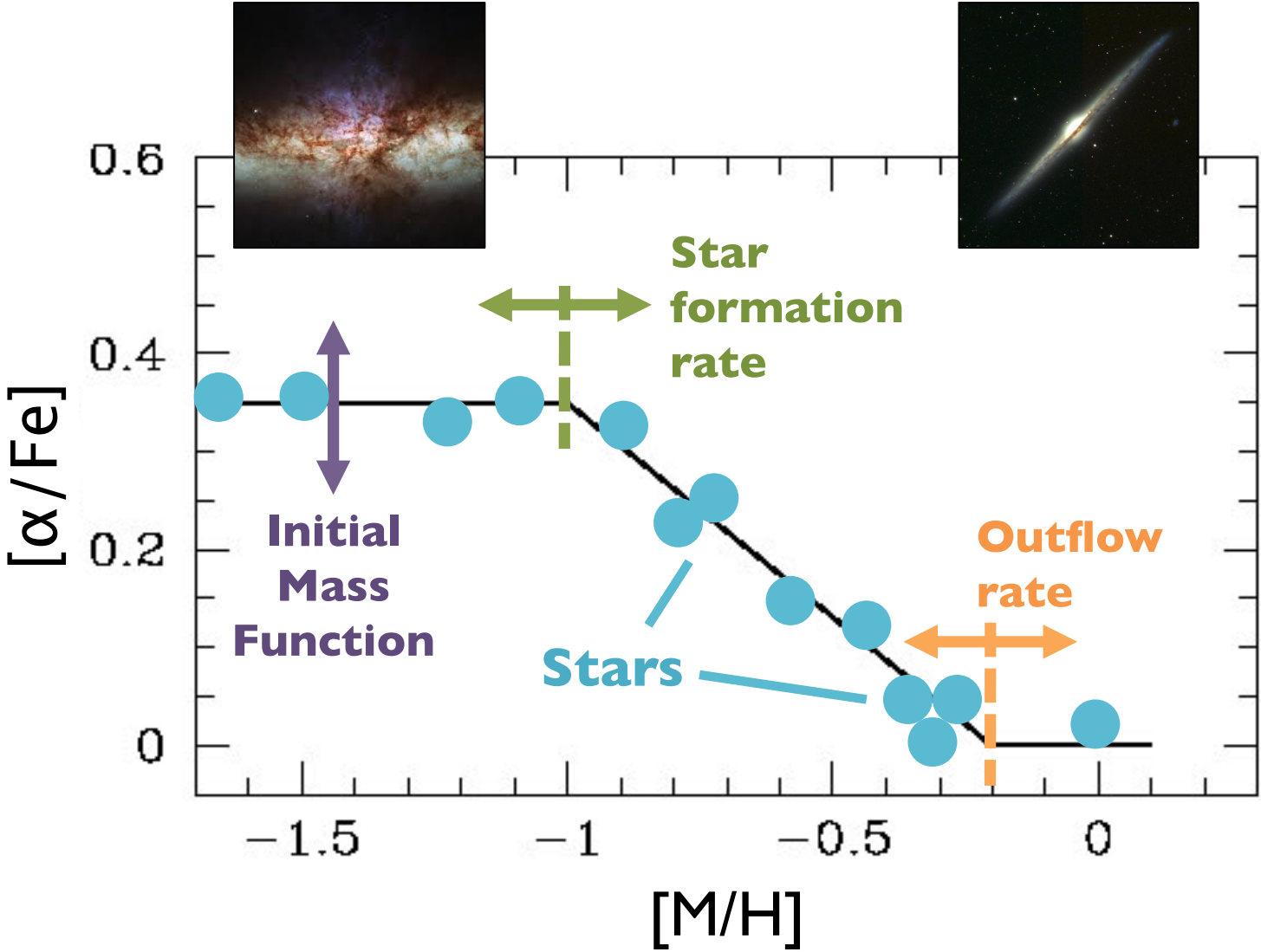
Abundance Correlations



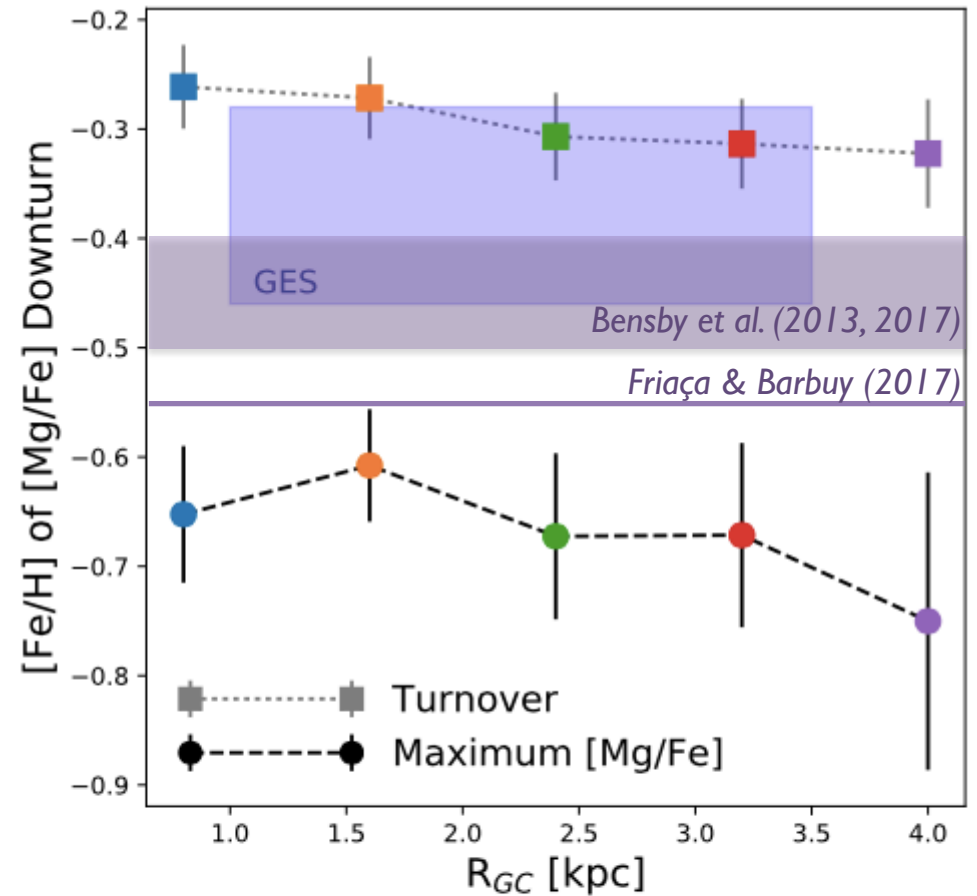
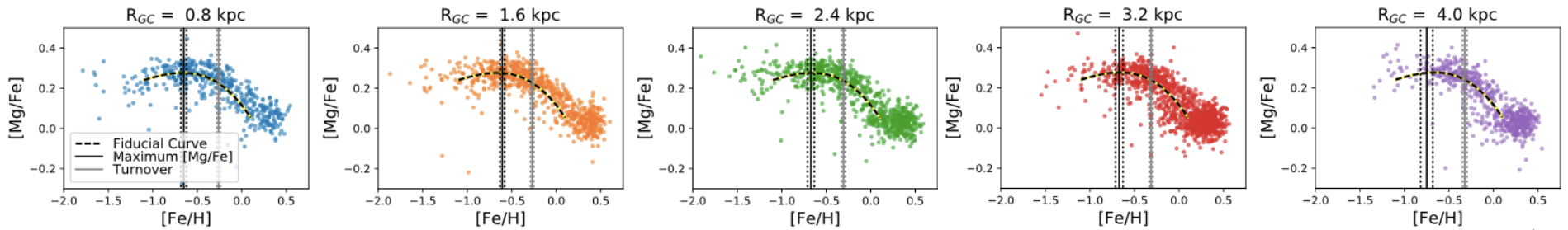
Abundance Correlations



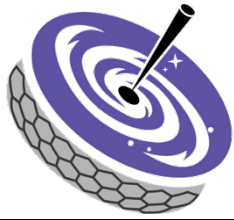
Diversity of Early SF Environment



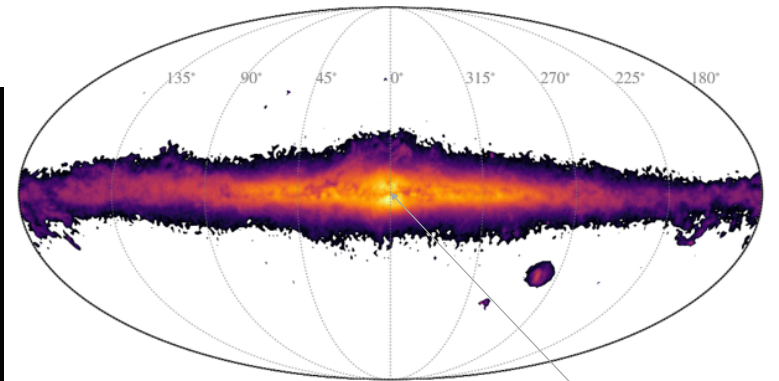
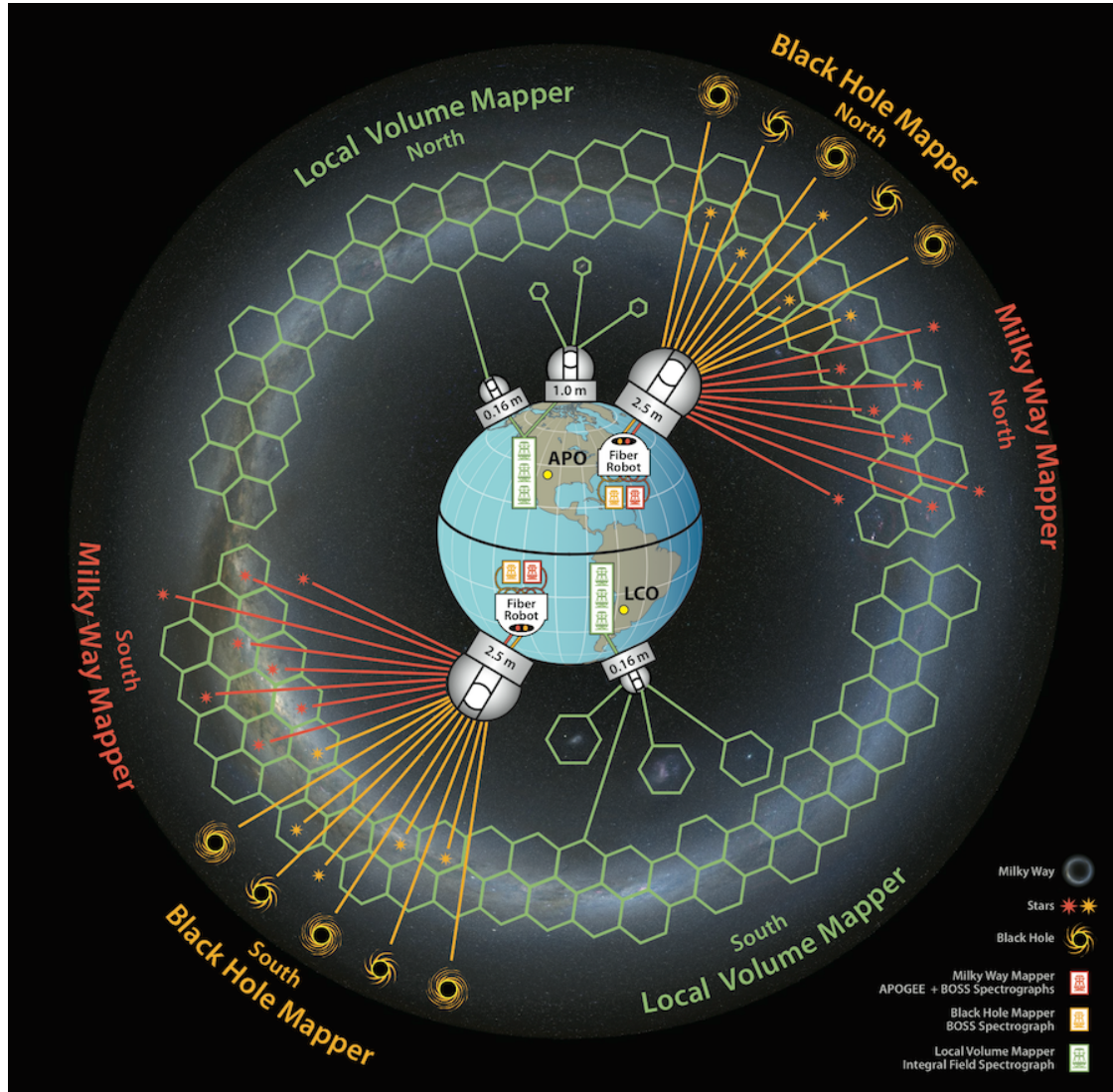
Diversity of Early SF Environment



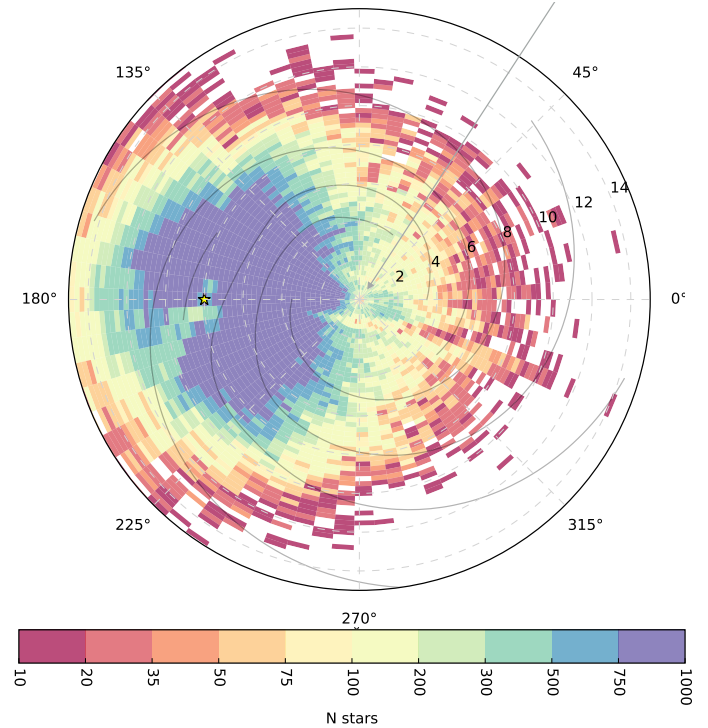
Boutique → Industry → ?



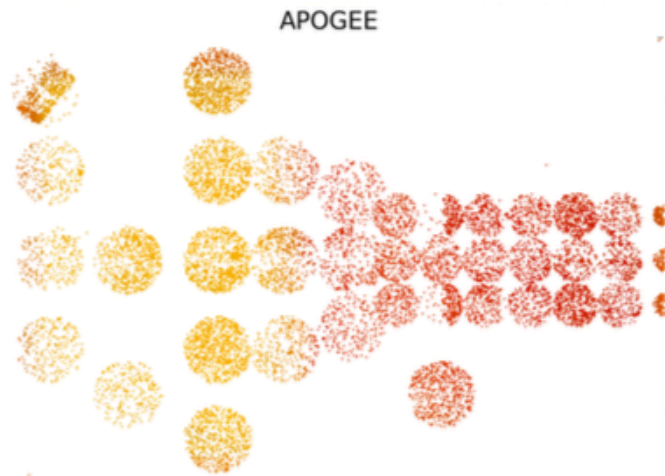
SDSS-V



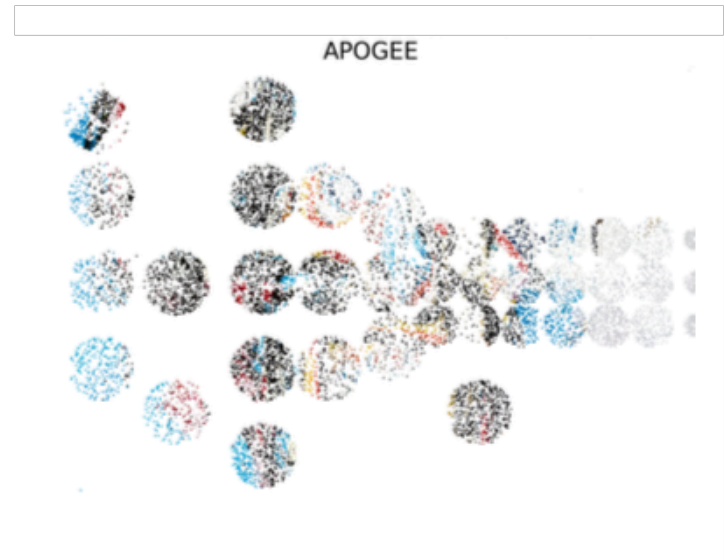
90° Galactic Center



Upcoming Data: SDSS-V

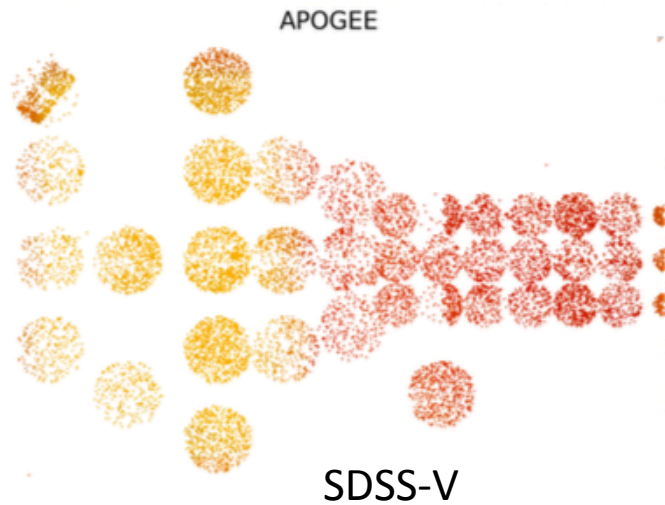


Milky Way Model A

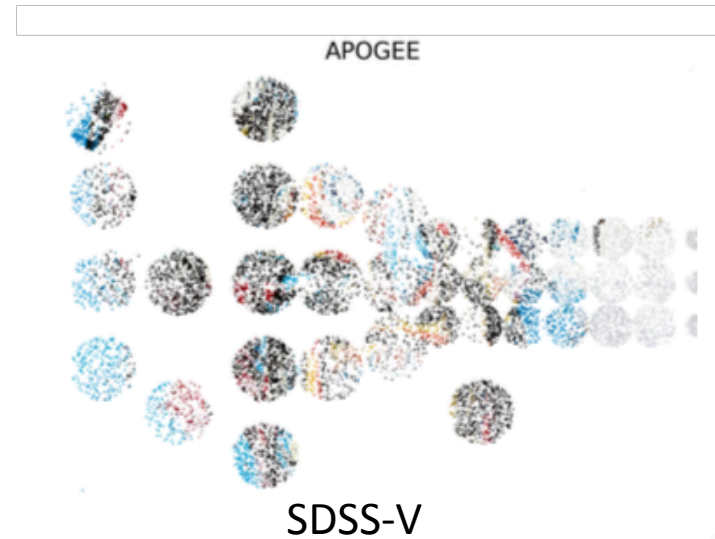


Milky Way Model B

Upcoming Data: SDSS-V



Milky Way Model A
Mark Rothko *Orange and Yellow*



Milky Way Model B
Jean-Michel Basquiat *Untitled*