SDSS IV会议总结

冯帅

主办方

- Sejong University, 世宗大学
- 李祹（朝鲜语：이도，1397年－1450年），即朝鲜世宗，字元正，李氏朝鲜第四代君主，朝鲜王朝第二任国王。

主办方

Sejong Cosmology Lab

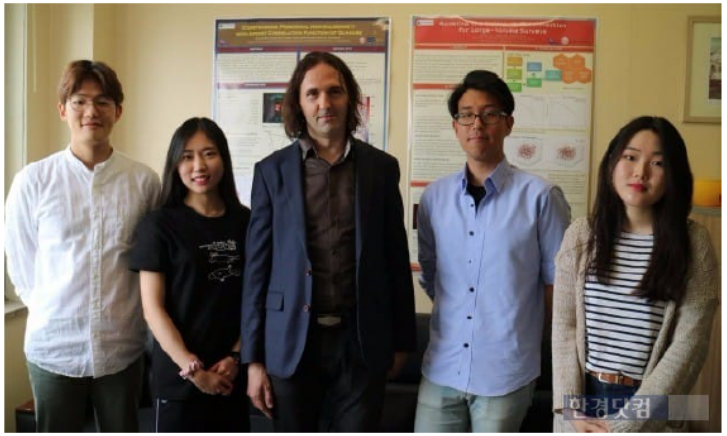
www.sejongcosmogroup.com

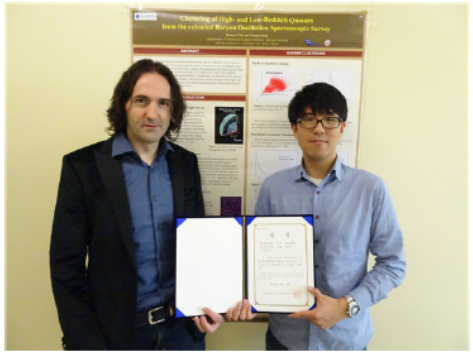
Sejong Cosmology Group

Welcome!

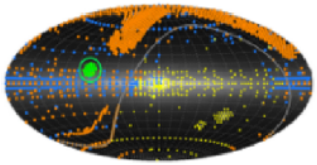
This is the Sejong University Cosmology Research Group

Meet the team

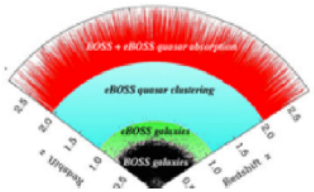




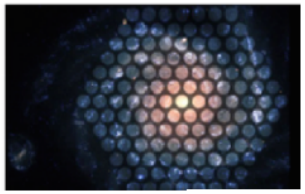
APOGEE-2



eBOSS



MaNGA



SDSS IV

- **APOGEE-2**: A near-infrared view of Milky Way structure and evolution.
- **eBOSS**: Expansion history of the Universe and growth structure since z = 3.
- **MaNGA**: A massive IFU survey of nearby galaxies.
- **SPIDERS**: Spectroscopic follow-up of X-ray selected AGN and Clusters of galaxies from eROSITA all-sky survey.
- **TDSS**: Spectroscopic follow-up of Celestial Variables.

Highlights of SDSS-IV Status

- Four successful years of taking data at Apache Point, and one full year at Las Campanas Observatory.
- Extra bright time at APO expanding APOGEE, pathfinding for SDSS-V.
- eBOSS finished its emission line galaxy program; eBOSS rescheduled to end in February 2019.
- Two public data releases, and regular delivery of data products to the collaboration.
- Major key science results from eBOSS and copious science coming from APOGEE-2 and MANGA.
- Now funded for six full years.
- SDSS-V activity a-brewing.

101 Milky Way Formation

By Majewski

The Science of Stellar Populations

WE SEEK: *Correlations* between stellar attributes such as:

- SPATIAL DISTRIBUTIONS: e.g., stellar density laws
- KINEMATICS: velocities, velocity dispersions
- AGES: traditionally hard to infer, but key to putting timestamps on other observed properties
- CHEMISTRY: e.g. mean "metallicity", characterized as [Fe/H]

chemical abundance patterns ([O/Fe], [Mg/Fe], [Nd/Fe], ...)

TO IDENTIFY/DEFINE: Principal G/galactic populations that allow us…

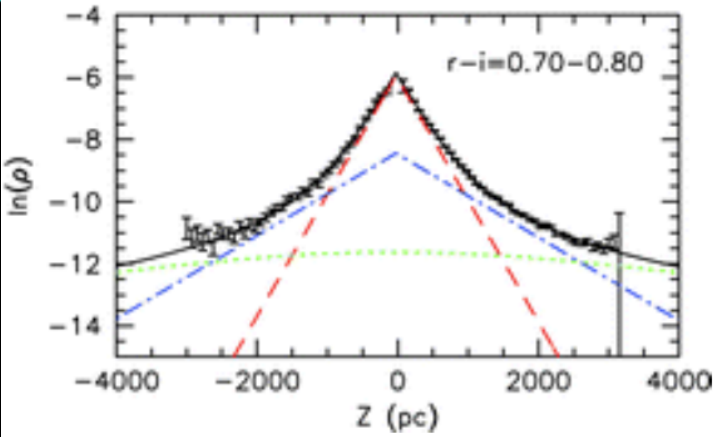
TO RECONSTRUCT: A complete, physical, *chemodynamical evolutionary model* of the Milky Way (or other galactic systems)

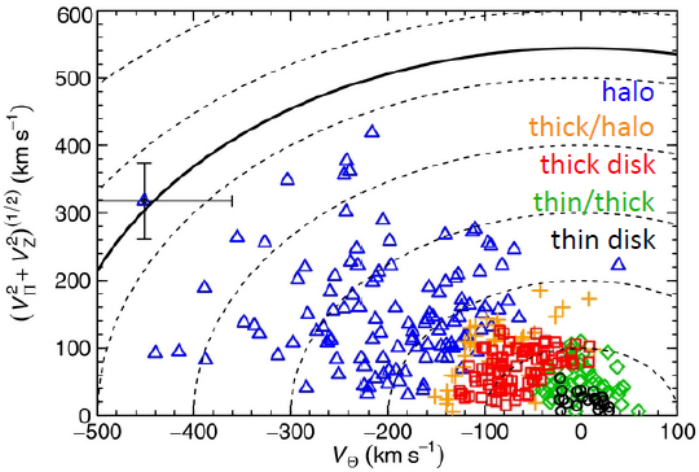
101 Milky Way Formation

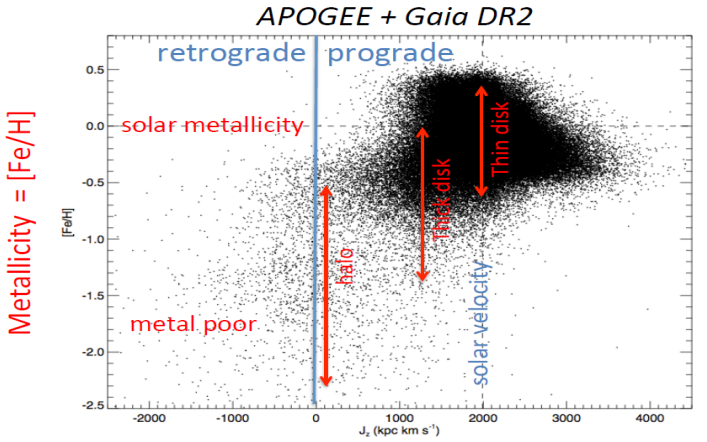
By Majewski

- Conventional Picture of the Milky Way
  - Halo (Pop II)
  - Thin disk (Pop I)
  - Thick disk (Pop II)
  - Bulge

- The Problem of Discrimina-ng Stellar Popula-ons
  - Spatial Overlap
    - Vertical stellar density (Buser+2000, Juric+2008)
  - Kinematical Overlap
    - Toomre diagram (Ruchti+2011, Katz+2018)
  - Metallicity Overlap







101 Milky Way Formation

By Majewski

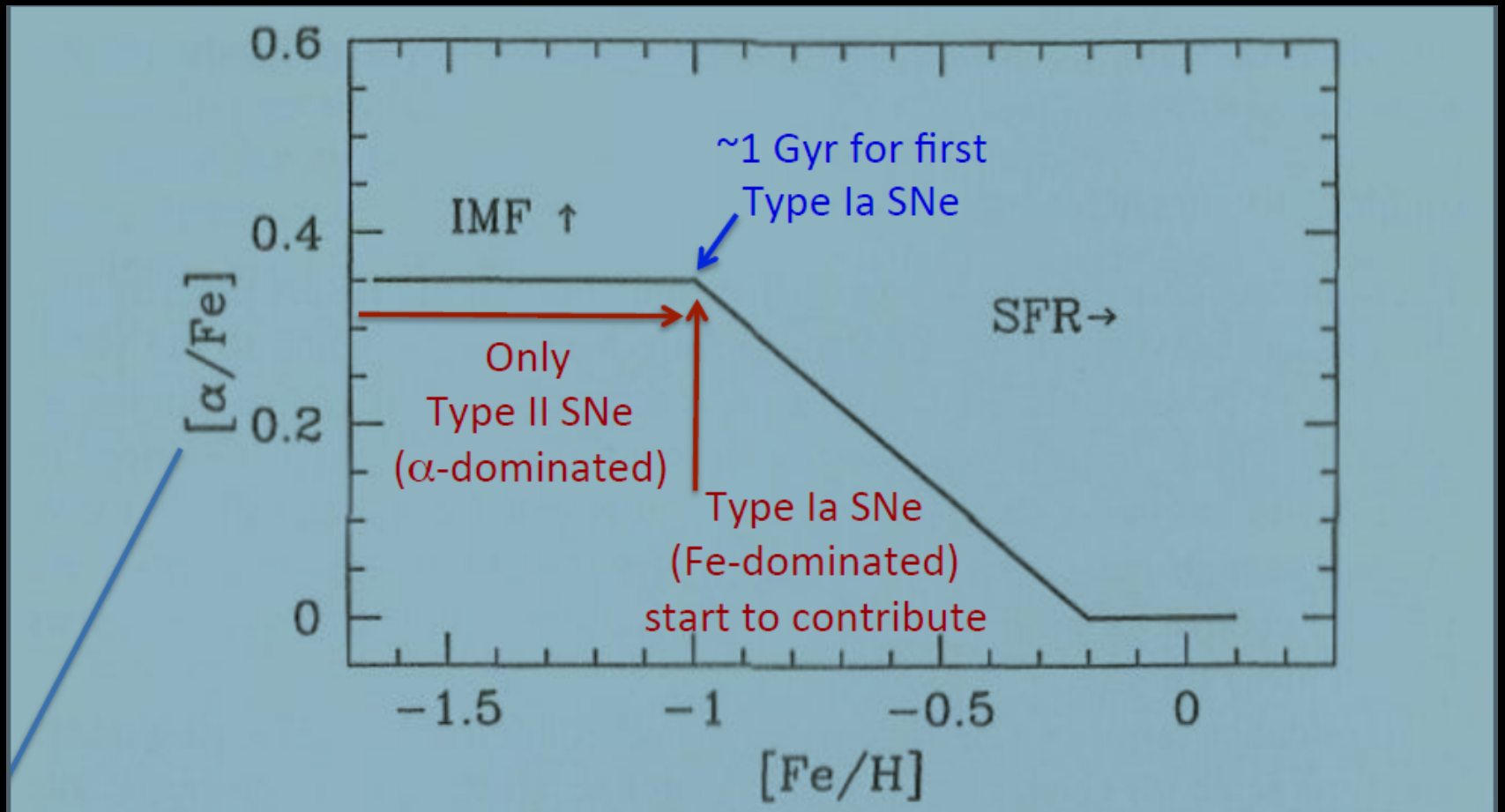


Figure 1 A schematic diagram of the trend of α-element abundance with metallicity. Increased initial mass function and star formation rate affect the trend in the directions indicated. The knee in the diagram is thought to be due to the onset of type Ia supernovae (SN Ia).

APOGEE Overview

By Katia Cunha and Verne Smith

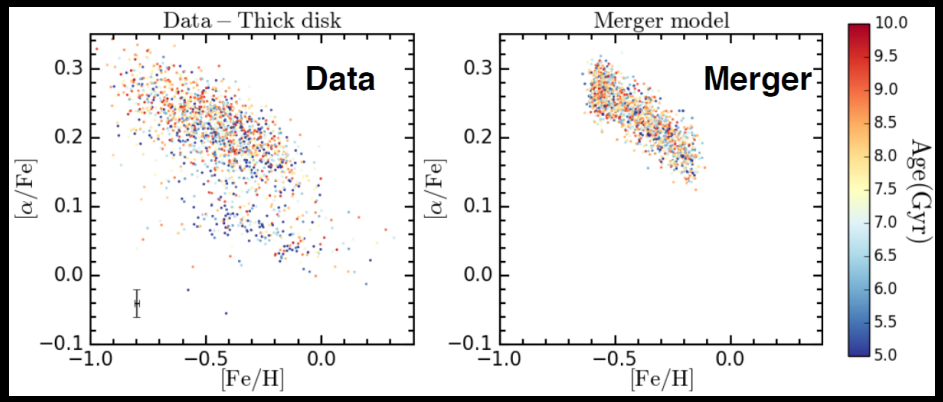
Summary Updates for DR14+

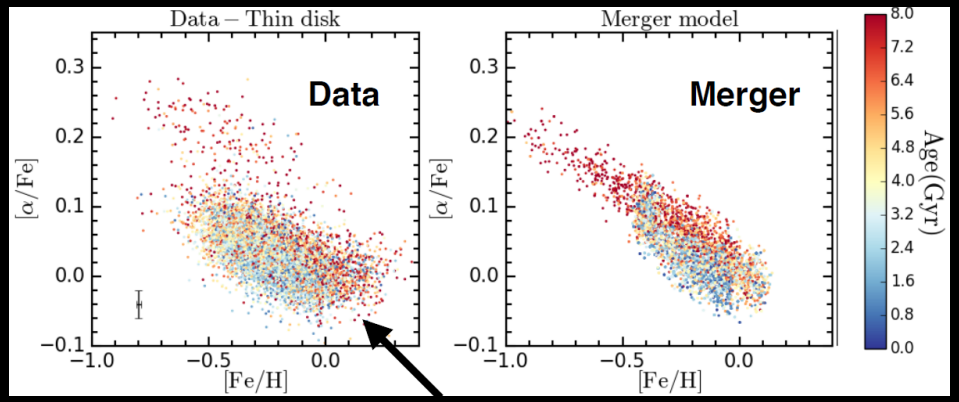
- New heavy-element neutron-capture elements
  - Ce II, Nd II, Yb II
  - Introduce the s- and r-process into ASPCAP
- New molecule: FeH
  - Crucial for bringing M-dwarfs into ASPCAP
    - select new windows tailored for M-dwarfs
    - Investigate needs for calibrations in Teff and log g using benchmark stars
    - TESS
- Updated molecular linelists and gf-values
  - OH: O-abundances may increase slightly (...but, sphericity?)
  - CO: C-abundances will increase slightly
- New/updated basic atomic line list
  - Kurucz October 2017: 4x more lines
  - Mostly more hfs and isotopic splitting
- Release new ASPCAP results to collaboration before end of CY2018

Chemical evolution of our Milky Way and external galaxies revealed by APOGEE and MaNGA

By Jianhui Lian

- Chemical evolution history:
  - Non-monotonic metal enrichment
- Merger history:
  - First merger at z~1 and the second at z~0.4
- Disk formation scenario:
  - Thick disk formed via the star burst triggered by the first merger.
  - Thin disk formed through smooth gas accretion but affected by the second merger which contribute ~10% of the thin disk stars.
- Observations:
  - High metallicity in gas than stars
  - Larger difference in low mass galaxies and at larger radii
- Physical origins:
  - Low mass galaxies and outskirt disks,
    - Lost more metals at early times due to a shallower gravitational well (metal retention)
    - Produced less metals at early times by steeper IMF (metal production)





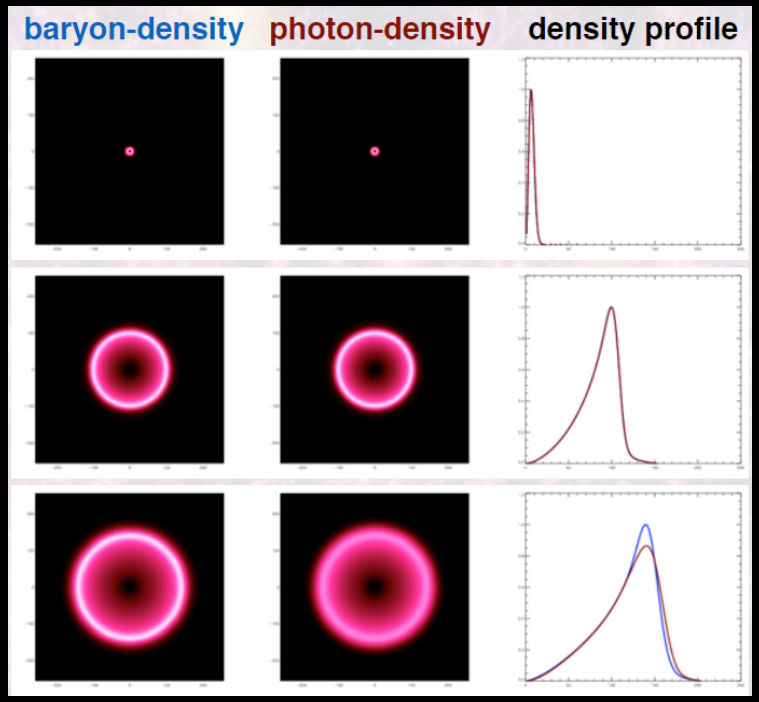
101 Structure Formation

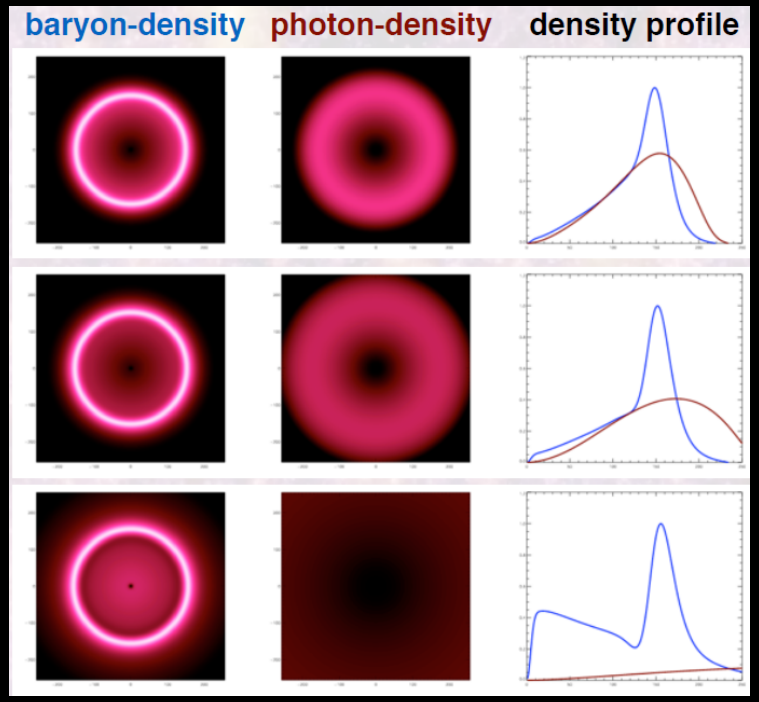
By Hector Gil Marin

- 星系成团性：两点相关函数

$$\xi(r) = \frac{DD}{RR} - 1$$

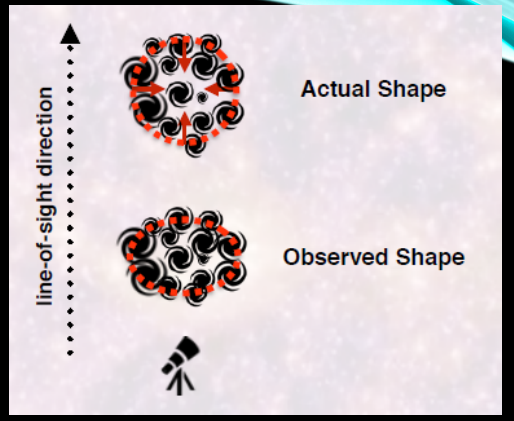
- 重子声波震荡（BAO）





By Hector Gil Marin

101 Structure Formation

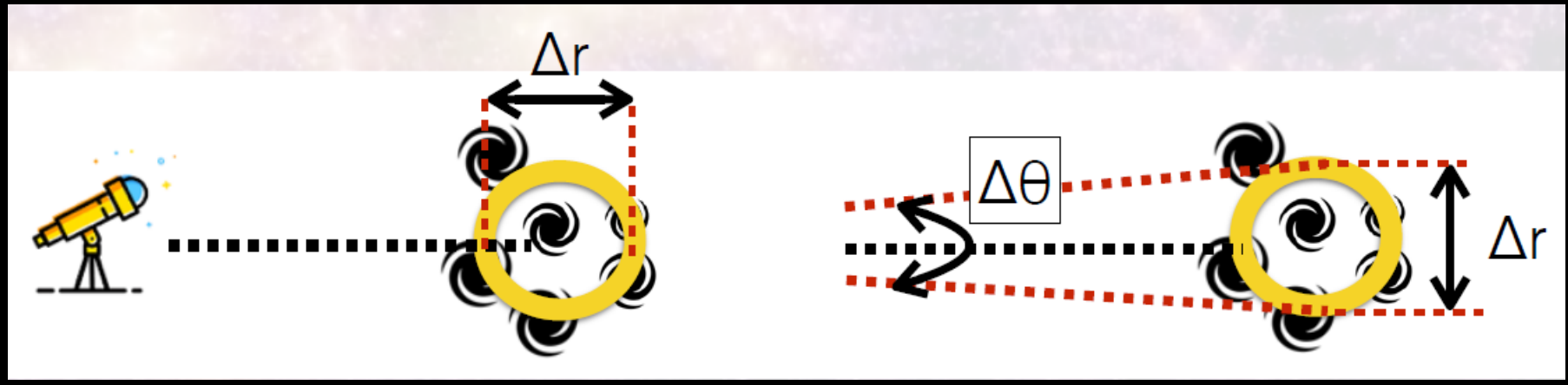


- Redshift Space Distortions (RSD)

RSD: Enhancement / reduction of the clustering along the line-of-sight (LOS) direction due to peculiar velocities (Kaiser 1987)

- Alcock-Paczynski effects

AP effect: Anisotropy induced by transforming redshifts into coming distances assuming a *wrong cosmology*



eBOSS Overview

By Hee-Jong Seo

Science goals of eBOSS (2014-2019)

- Understand cosmic acceleration: **Dark Energy** measurements via baryon acoustic oscillations (BAO) for $0.6<z<3.5$
  - 1-2% precision measurements from all 4 BAO tracers → key science
- Modifications to General Relativity as possible alternative to **dark energy**
  - Redshift Space Distortions (RSD) measure growth rate → key science
- Tests of **inflation** and **neutrino** masses
  - Beyond science requirements
  - Expect new constraints in parallel with key deliverables
- Fills the time gap between BOSS (2000-2014) and DESI (2019-2024)
  - the new redshift coverage from BOSS -No BAO measurement $0.9<z<2.2$
  - Lay the groundwork for the target selection and analysis techniques for DESI

eBOSS Overview

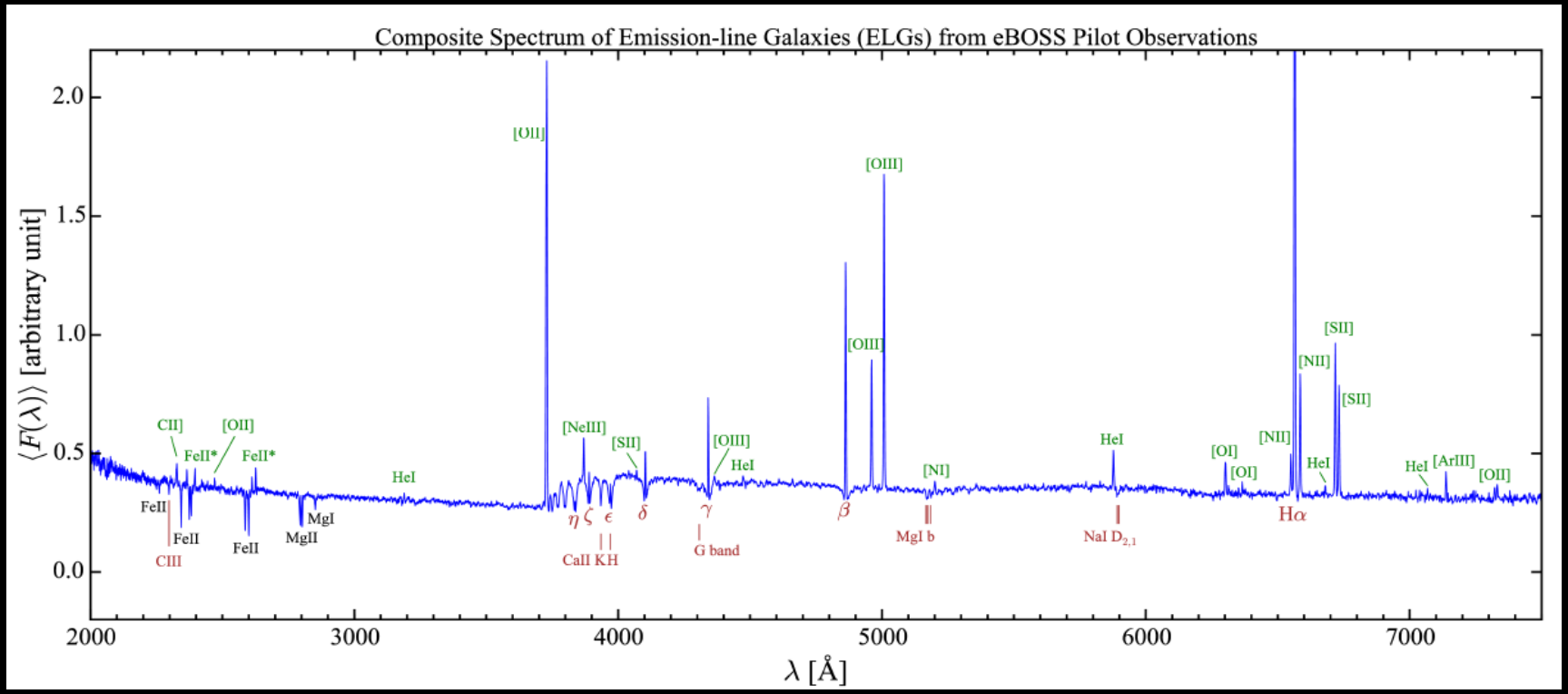
By Hee-Jong Seo

- Luminous Red Galaxies (LRG; 0.6<z<1.0; Prakash et al. 2016)
  - Selected from SDSS and WISE infrared satellite images
  - Higher redshift than BOSS galaxies, established methodology
- Emission Line Galaxies (ELG; 0.7<z<1.1; Raichoor et al. 2017)
  - DESI-like selection from DECam images (first application for massive spectroscopy). Useful for DESI.
  - Observations is complete in February 2018
- Quasars (0.9<z<3.5; Myers et al. 2015)
  - SDSS/WISE selection
  - Already allowed first BAO measurement directly from quasars
- Lyman alpha forest (2.1<z)
  - Enhance BOSS program with 60k new and 60k reobserved QSO
  - Improve analysis algorithms and new techniques for clustering measurement

Clustering in the eBOSS ELG sample

By Arnaud de Mattia

- ELG(Emission Line Galaxies)
  - Based on DECaLS photometry, deeper than SDSS
  - 0.6 < z < 1.1



MaNGA Overview

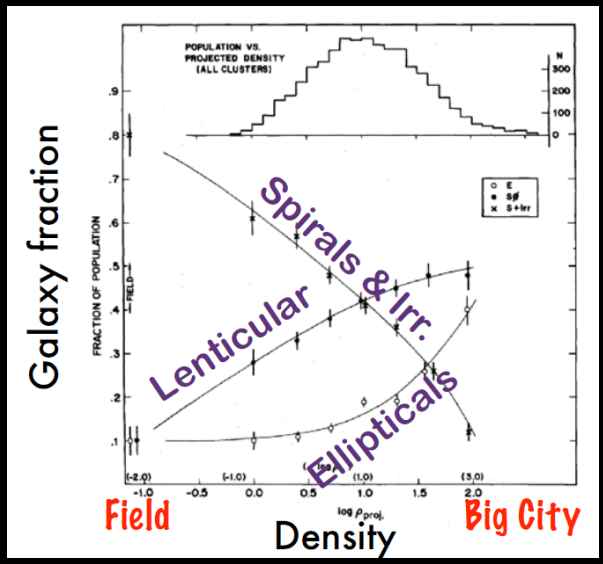
By Westfall

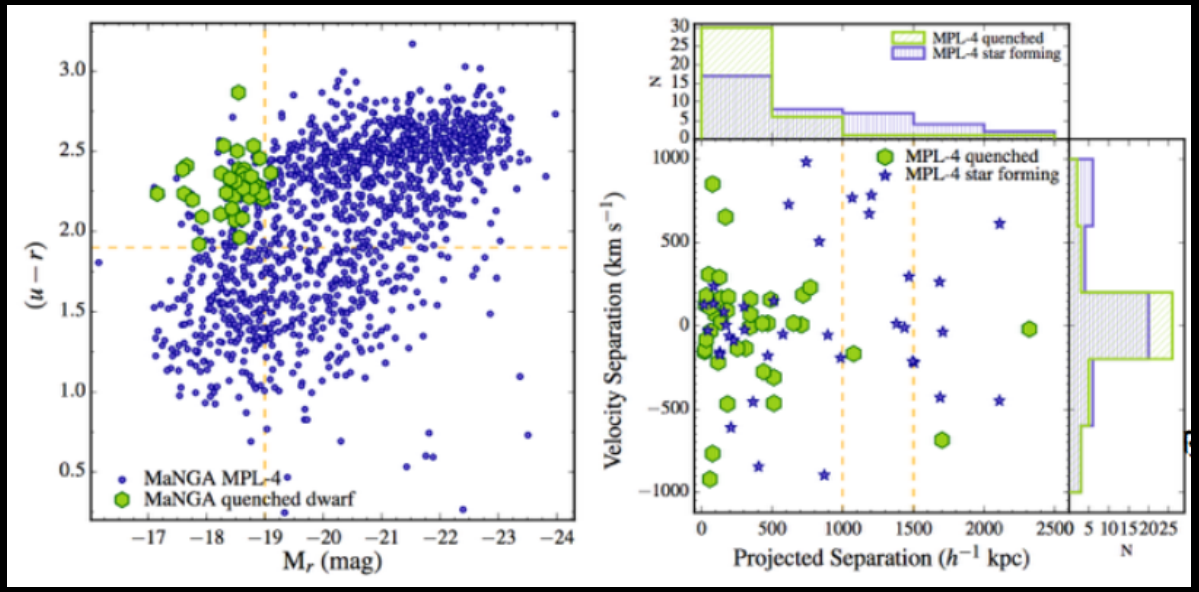
- Progress
  - 379 completed plates: ~6350 galaxies (MPL-8)
  - 637 predicted plates by survey's end, 8.3% gain with eBOSS trade
- New in DR15
  - DAP (stellar kinematics, ionized-gas kinematics, emission-line flux and EWs, Spectral Indices
  - Marvin
  - MaStar: the MaNGA Stellar Libaray
- Science
  - AGN: Properties, Kinematics, Influence
  - Kinematics & Dynamics: Characterization, Alignment, Angular Momentum, Pattern Speeds
  - Galaxy growth and death: Stellar populations, Starformationhistories, Global vs. Local scaling relations, Quenching, Star-formation-Mass sequence and scatter

101 Galaxy Enviromnent

By Maria Argudo-Fernández

- Morphology-Density Relation
- Age & Stellar mass vs Environment
- Merger, interaction, AGN
- Environmental quenching
- Kinematic morphology-density relation
- Galaxy Environment for MaNGA - VAC





Gas, dust and stars: a multiwavelength picture of galaxy evolution with MaNGA and ALMA

By Rowlands

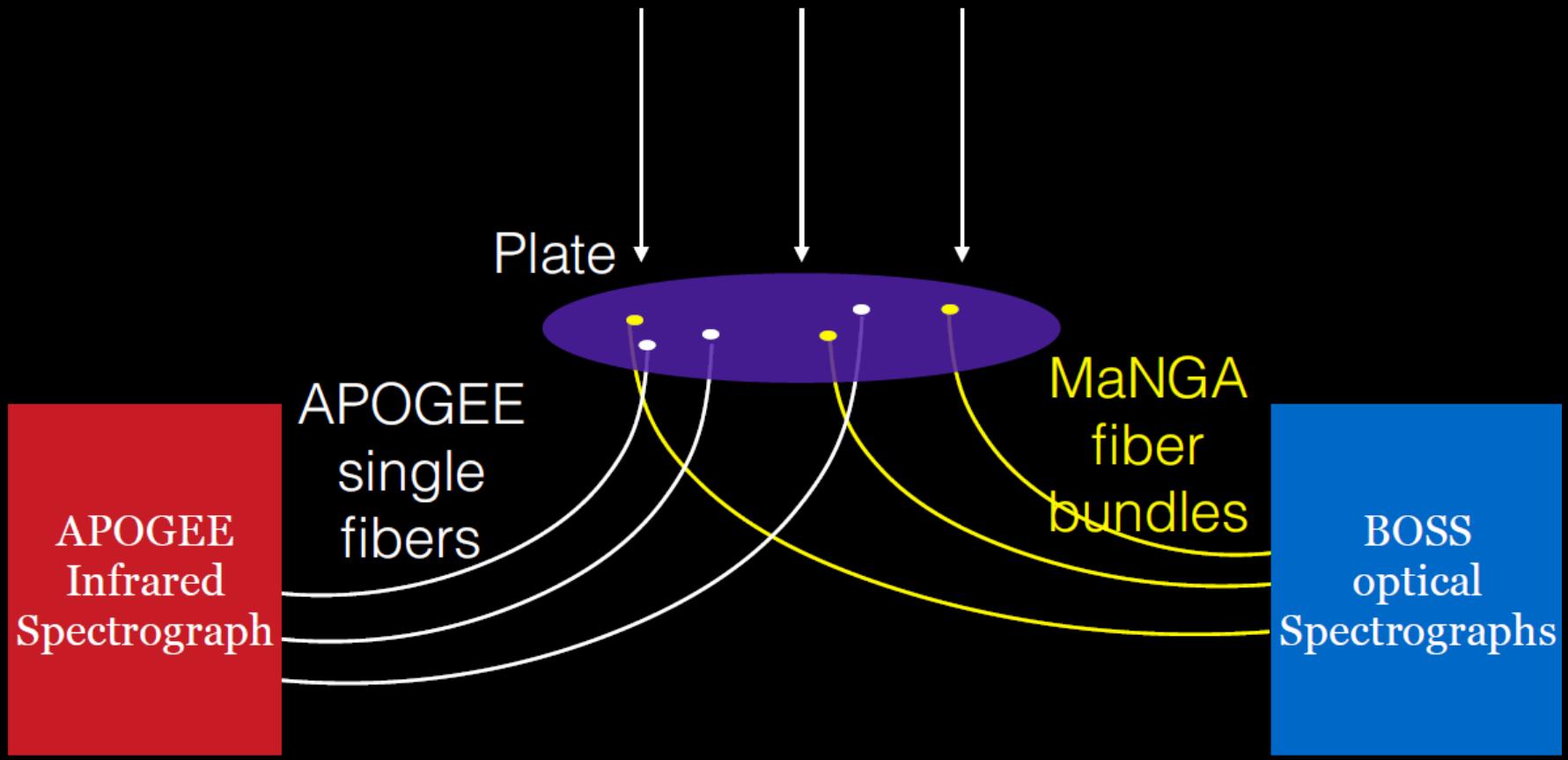
- 星系演化 ➔ 气体含量+恒星形成率 ➔ 分子气体密度 ➔ 小尺度过程
  - K-S law

What can I observe with ALMA?

- Sun – coronal mass ejections, magnetic field activity
- Solar system, KBOs – atmospheres, astrometry, composition
- Star-forming regions – dust and gas environment, kinematics (infall, outflows, jets), proto-planetary disks, cores, chemistry, feedback, and natal cloud / star interactions
- Exoplanets – direct imaging, gaps in disks, kinematics
- Pulsars – neutron star physics, pulse morphology, gravity, ISM probe
- Galactic structure – spiral arms, bars, global atomic and molecular gas properties
- Nearby galaxies – molecular / atomic gas content and kinematics, dynamics of galaxies at high resolution, star formation, obscured SF, gas flow
- Galaxy groups and clusters – atomic and molecular gas across systems, star formation efficiency, kinematics, dynamical mass measurements
- Black holes – mass measurements, kinematics
- High redshift galaxies – extragalactic background light, source counts, star formation history and efficiency, evolution of gas content (atomic and molecular)
- Cosmology – H_0 measurement, SZE

MaStar: MaNGA Stellar Library

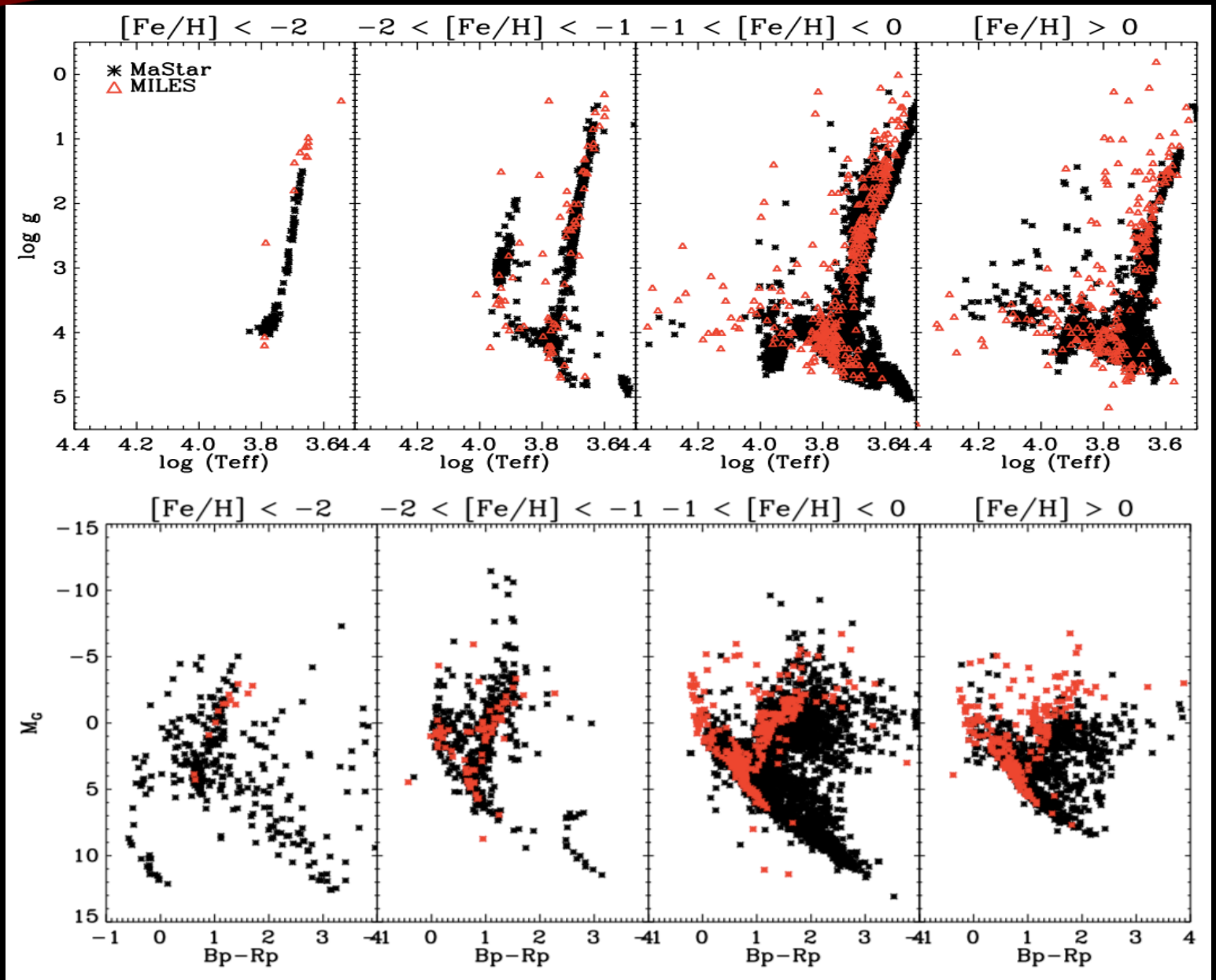
By Renbin Yan



Dark Time: MaNGA leads, APOGEE piggybacks
Bright Time: APOGEE leads, MaStar piggybacks

MaStar: MaNGA Stellar Library

By Renbin Yan



SPIDERS Overview

By Del Moro

- SPectroscopic IDentification of eROSITA Sources

VACs in DR14

- VAC#8: SPIDERS X-ray galaxy cluster catalogue for DR14 (Clerc et al.)
- VAC#19: The Brightest Cluster Galaxies properties of SPIDERS X-ray galaxy clusters (Erfaninafar et al.)
- VAC#20: Multi-wavelength properties of RASS AGN (Merloni et al.)
- VAC#22: Multi-wavelength properties of XMM-Slew Survey AGN (Merloni et al.)
- VAC#34 (DR15): Optical Emission Line Properties and Black Hole Mass Estimates for SPIDERS DR14 Quasars (Coffey et al.)