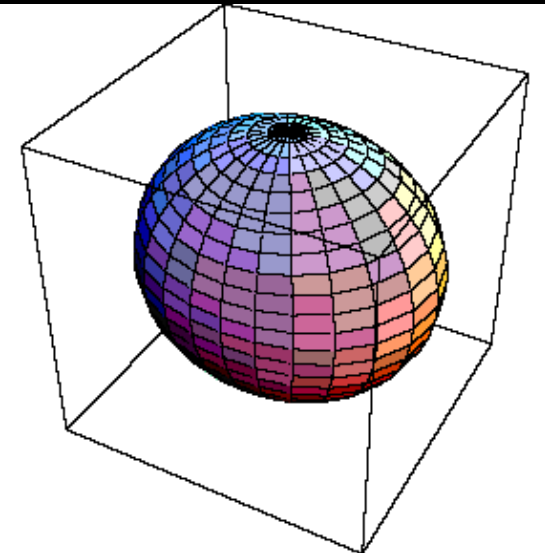
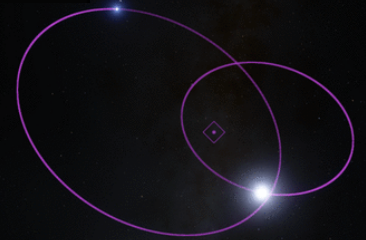
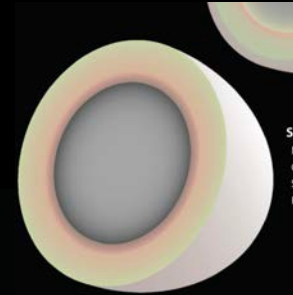


Milky Way Mapper and you



Jennifer Johnson
Program Head
Milky Way Mapper



Overview

- Current open areas where you as an SDSS-V member can have an impact
 - Working Group leads and members
 - Data Reduction and Analysis
- Overall plan of observation
- Upcoming schedule

Shaping the Mapper

- Broad outlines in place – see HWR talk
- Many open questions
 - Most efficient targeting to address science questions (e.g., YSOs)
 - Cadence requirements (e.g., WDs)
 - Prioritization among the different programs
- Exploiting all the quanta
 - Follow-up of Gaia, e.g., breaking degeneracies in astrometric binaries?
 - Filling all the BOSS fibers
 - Dark time – halo stars?
 - Bright time – red clump stars?
 - Extending the Solar Neighborhood Census or TESS samples?

Science & the Mapper

- No opportunity like being the SDSS-V team to get what you want measured
 - Define the outputs of the pipelines
 - Interaction with the Working Groups and the Data Analysis Team
 - Contributed effort that can be incorporated into the pipelines
 - Key expertise = exploiting the data
 - Cross-field expertise – e.g., dust and Galactic Genesis

The Goal of Milky Way Mapper

- Understanding the Milky Way and the physics of its stars
- Three areas of exploration
 - **Galactic Genesis** – ~5 million stars with moderate S/N
APOGEE spectra, white dwarf chronicle
 - **Stellar Astrophysics** – star formation, stellar structure from spectroscopy + asteroseismology for hot stars & red giants, survey of the solar neighborhood
 - **Stellar Systems Architecture** – binaries wide to interacting, binaries across the Galaxy, characterization of TESS planet hosts

Milky Way Mapper -- Resources

SDSS will operate the APOGEE and BOSS spectrographs at Apache Point and Las Campanas Observatories

- One BOSS spectrograph (500 fibers) and one APOGEE spectrograph (300 fibers) in each hemisphere
- Fiber positioning system on each telescope: 300 robots with both APOGEE/BOSS fibers and 200 with only BOSS fibers
- ~300 nights a year at each observatory

Milky Way Mapper -- Resources

- MWM will control telescope pointing and fiber allocation for the bright tie
- MWM will also have $\sim 1/4$ of the dark time + a few fibers that the Black Hole Mapper will not use during their dark time
- If we define a MWM quantum by the Galactic Genesis exposure time of 15 minutes, there are ~ 10 million MWM quanta available in bright time. GG will use $\sim 1/2$ of those
- In many cases, several quanta can be devoted to a single object, giving RV variability or orbits, higher S/N, etc., depending on the science case

“Control” Patterns

- Three combinations of sky coverage, moon phase, and cadence that will control much of the MWM pointing
- Galactic Genesis
 - 1 quantum in bright time for all stars w/ $G-H > 3.5$ & $H < 11$
 - At all latitudes, but most of the stars that meet this criterion are in the disk (also SF regions)
 - For dense fields, this means returning again and again to the same patch of sky – can be spread out in time

Control Patterns

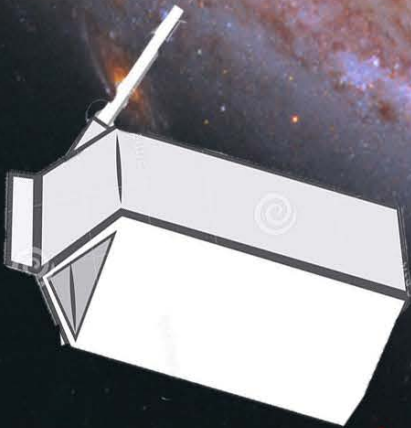
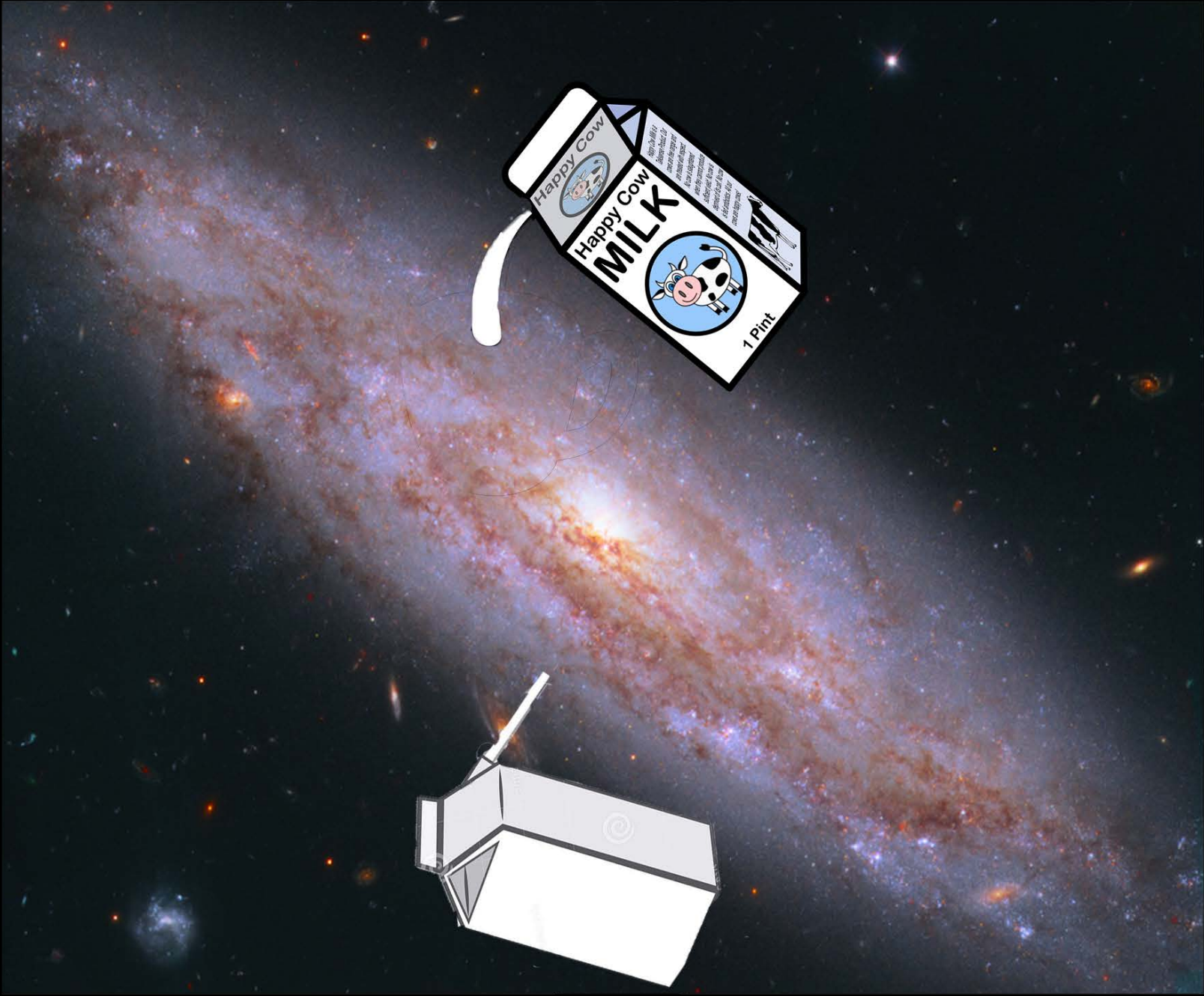
- TESS Continuous Viewing Zones
 - 2 visits to all OBAF stars to check binary status
 - 25 visits to ~100 OBAF in each CVZ
 - Comparison of stellar properties from seismology & dynamics/eclipse properties
 - S/N~ 70-100 of short-cadence TESS targets
 - Includes planet hosts & those searched for planets & TASC targets
 - S/N~70-100 for oscillating red giants

Control Patterns

- Low-luminosity stellar survey
 - All-sky dark-time 2 epochs (closely spaced but not back-to-back) of white dwarfs identified by Gaia to $G \sim 20$
 - Single-epoch observations of all stars < 100 pc of the Sun
 - Both APOGEE and BOSS spectra for as many stars as feasible
 - Rely on BOSS spectra for the WD and later M dwarfs

“Cartons”

- A “carton” is the name for programs within the Solar Neighborhood Census or the TESS RGB follow-up
- Each carton is defined by
 - Target selection criteria
 - Cadence criteria
 - Maximum moon conditions
 - Required SNR
 - Wavelength coverage (APOGEE/BOSS/both)



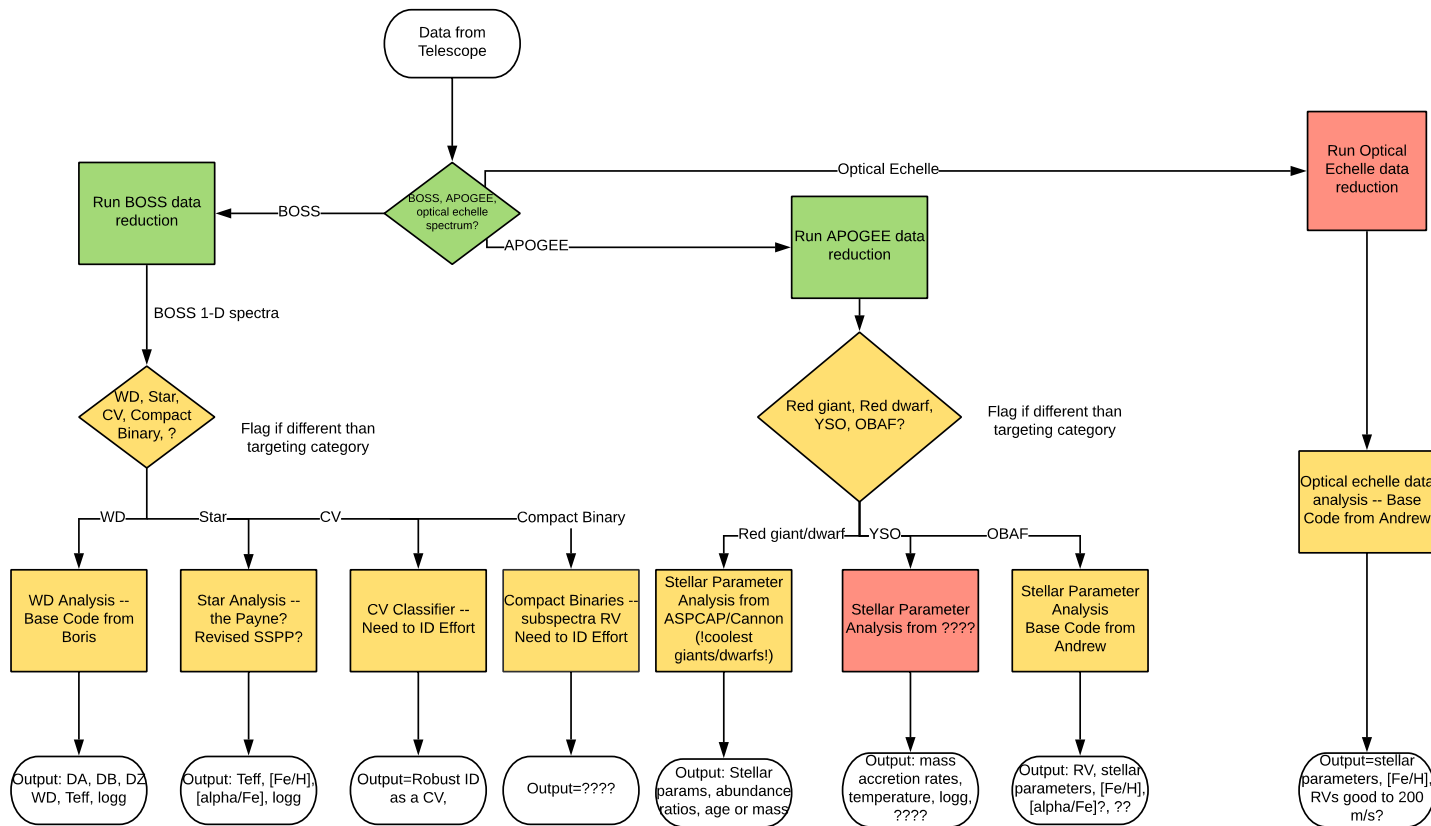
Science Requirements

- Most demanding technical requirements from key cartons
- Galactic Genesis – fiber positioner system, a lot of time on the disk
- WD properties – blue throughput for BOSS spectrographs, all-sky, 2-epochs
- Accuracy of parameters – exposure times
- RV – optimistic for a 30 m/s APOGEE rms

Project Execution Plan

- What we plan on doing
 - Includes plans for re-evaluating targeting in light of developments from Gaia, TESS, etc.
- Once the SRD and the PEP are in place, major changes will need to be reviewed by the Change Control Board (Director, Project Scientist, Survey Operations, etc)
- So the time for opinions is now!

Data Analysis Plans



Help!

We have *many* opportunities to become involved!

- Fill spots in the org chart, including data management roles and WG chair positions
- Software for optical echelle data reductions, pipeline for YSOs, your favorite type of object here
- PEP calculations – how many stars do we need for your carton?
- Target selection tests and feedback for the autoscheduler
- Website/wiki work, social media (blog posts, Twitter, Facebook)
- Your idea here!

Hardware Schedule

- By Fall 2020
 - Orders to robots
 - Reduce and analyze the data to make sure it is meeting SRD and so we can SCIENCE
- To make sure we have the software we need & the hardware fits our SRD needs, we need to start having answers to some questions and identify paths to addressing the rest.
 - Placement of APOGEE+BOSS fibers on the focal plane
 - Path to FP and 30 m/s
 - Number of APOGEE fibers & 1-meter NMSU fiber

Key Milestones for MWM

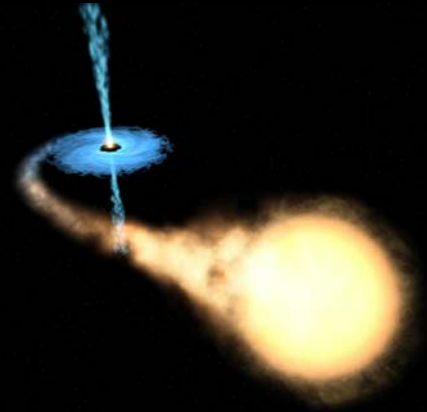
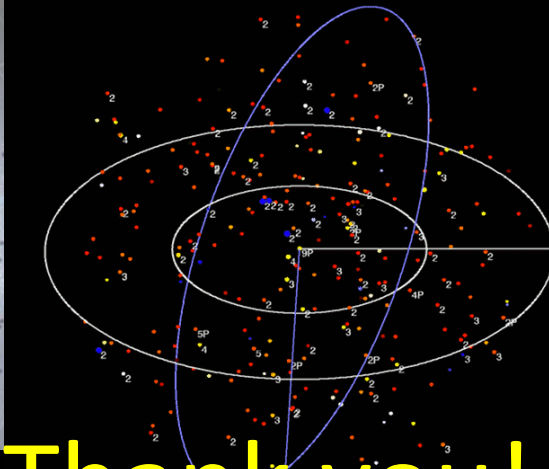
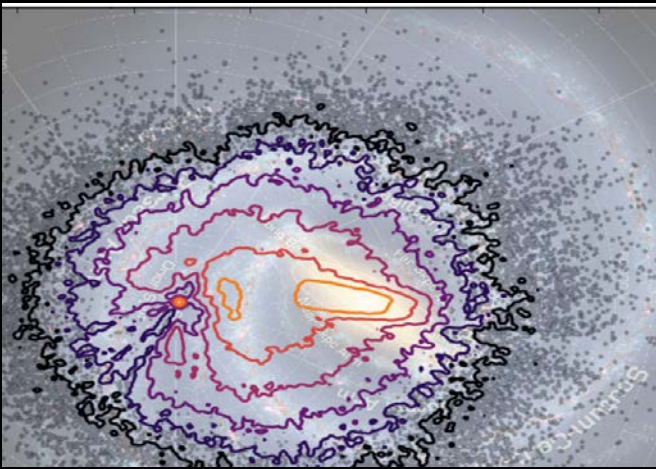
- End of March – version 1 of the SRD

Targeting:

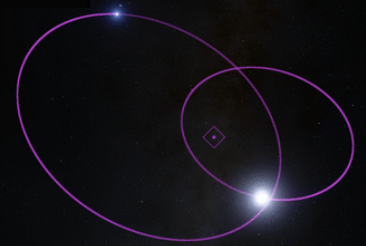
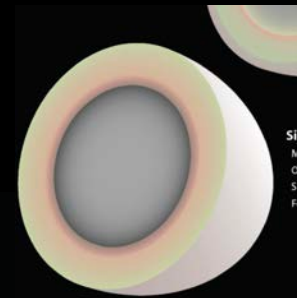
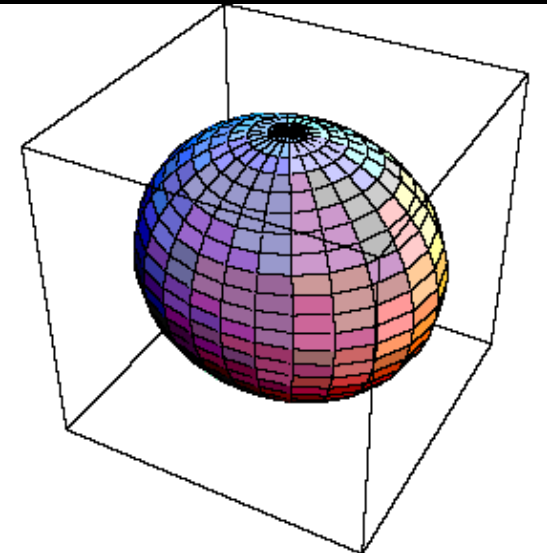
- End of May – first pass target criteria (i.e. mag. and color limits, cadence, number) for each carton
- Summer 2018 – first pass on flagging the targetdB & running of survey simulations
- Fall 2018 – iterate on target criteria in response to survey simulations

Key Milestones for MWM

- Summer 2019 – finalize fields to drill plates for Data Analysis and Reduction
- Now – understand the photometric data
- Summer 2018 – data to test classifier
- ASAP – start work on Data Reduction and Data Analysis Pipeline modifications, classifier
- Fall 2019 – run archival sets of SDSS data representing all cartons through complete versions of DRP and DAP



Thank you!
Questions?



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