MULTI-SURVEY AND STATISTICAL METHODS FOR COOL WHITE DWARF DISCOVERY

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Project Overview

- Goal: ID new WDs, emphasis on Solar Neighborhood for parallax candidates.
- Initial Target Selection Process
- CTIO 4m Spectroscopic Observations & Results
- Revamped Target Selection – New Techniques.
- APO 3.5m Spectroscopic Observations & Results

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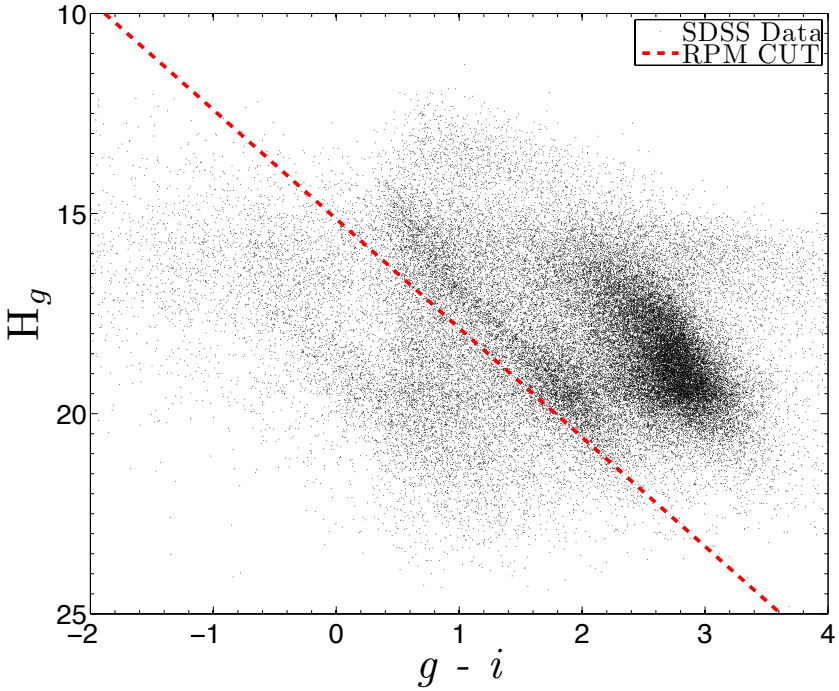
Initial Target Selection

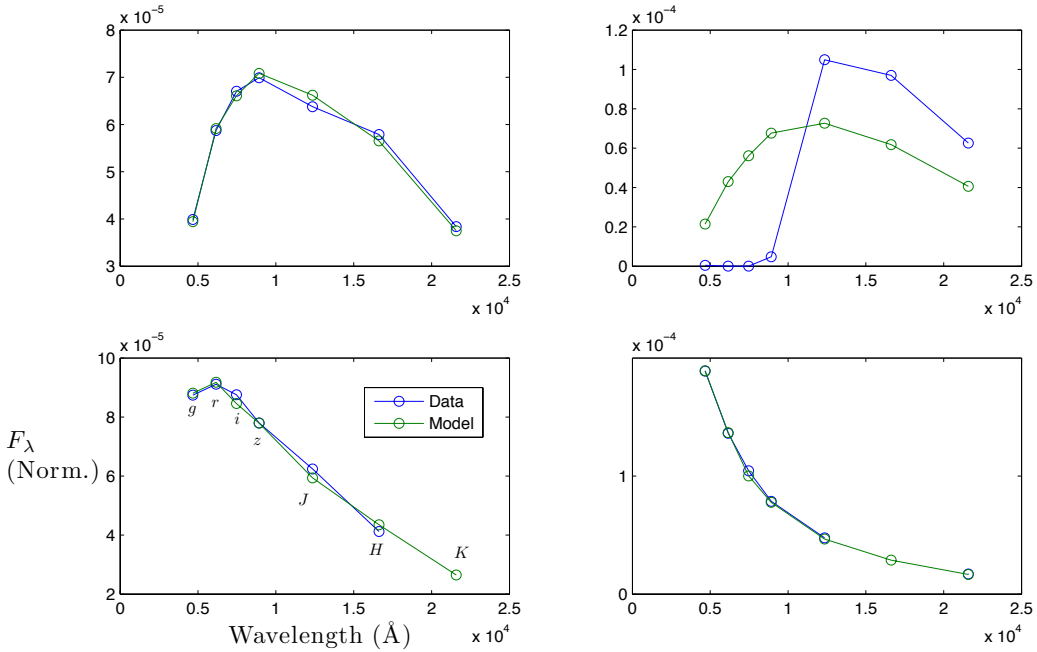
- SDSS DR7 Query:
  - g Mag < 19.5
  - Declinations south of $+30$ deg
  - 60,000 objects
- Reduced Proper Motion Cut:
  - USNO-B Astrometry
  - Keep WDs
  - Defined in Kilic et al. 2006
- Cross-Match with 2MASS
  - $J - K$ cut < 0.5
- Detectable Proper Motion Verification (By Eye)

$$\mathrm{H} = m + 5 + 5 \log \mu$$



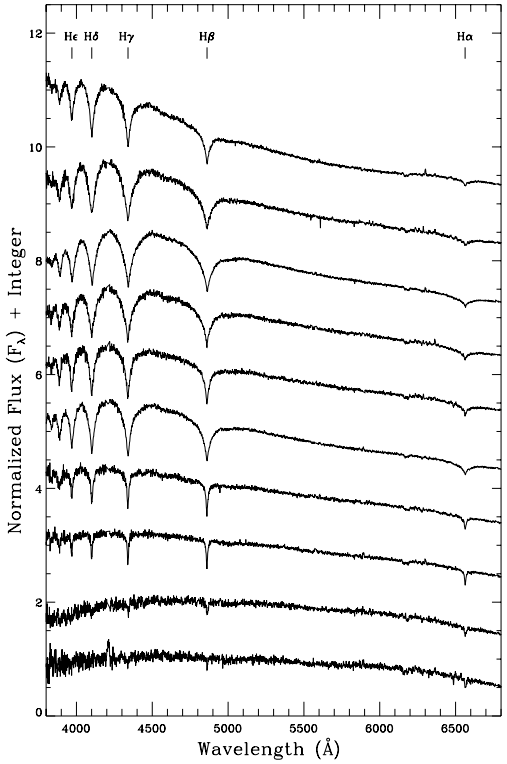
Initial Target Selection

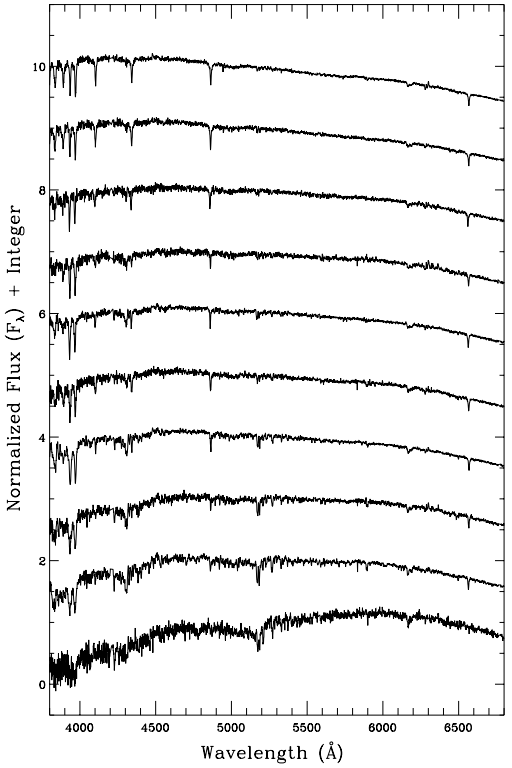
- Atmospheric Modeling
  - DA (pure hydrogen) Atmosphere Synthetic Photometry Tables (Bergeron)
  - Assume log g = 8
  - Temp & Dist Estimates
  - Poor Fits Thrown out



CTIO Observations

- 4m Blanco Telescope
  - RC Spectograph
  - 12 WDs
    - 10 DA
    - 1 DQ
    - 1 DC
  - 18 SDs
- SDSS Spectra (Freebies)
  - 13 WDs
    - 10 DA
    - 1 DB
    - 2 DC





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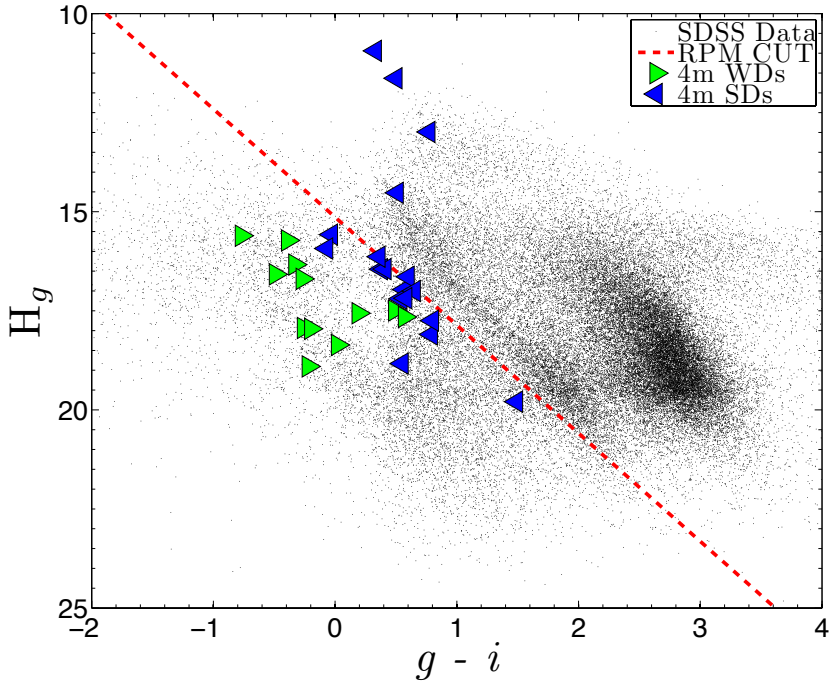
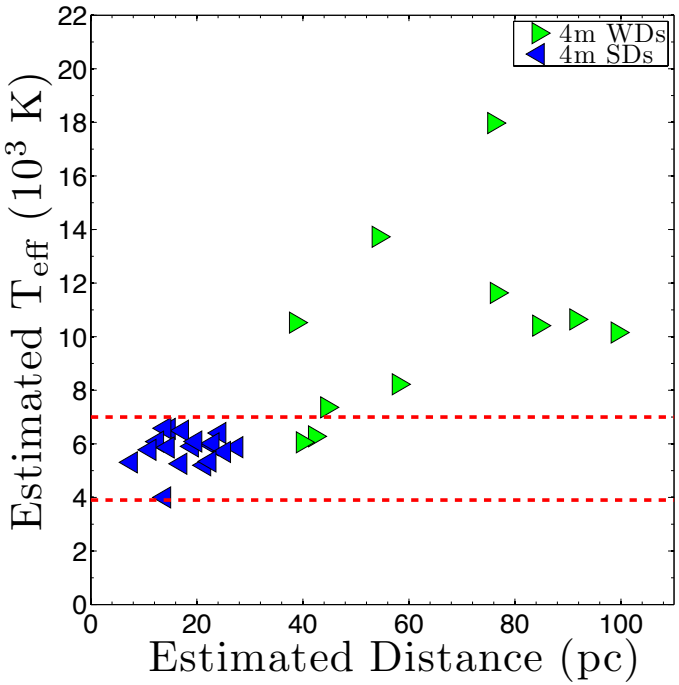
CTIO Observations
Quantifying SD Contamination

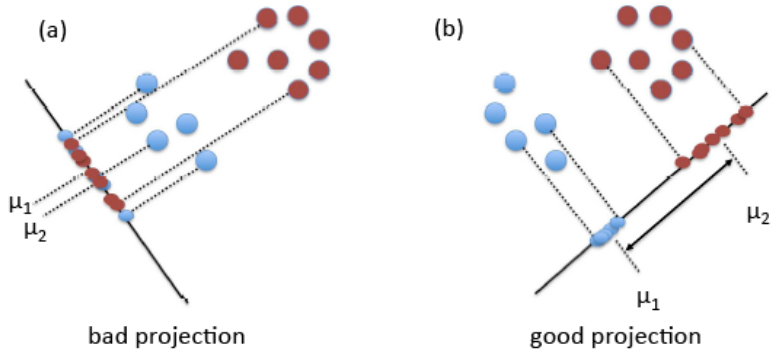
- Erroneous proper motion values
- Narrow T_{eff} Range





Revamped Target Selection

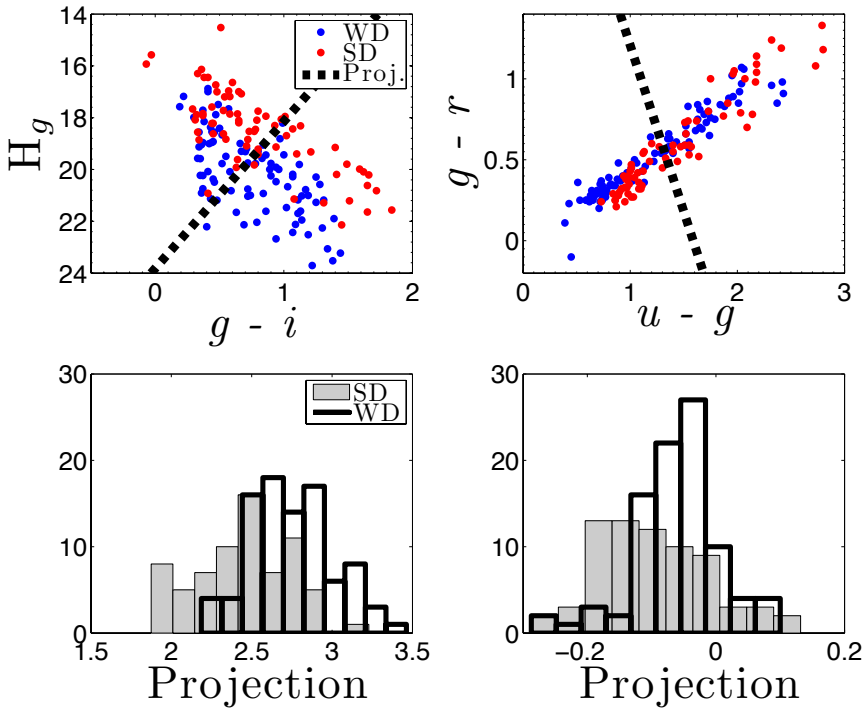
- Different:
  - Only HPM objects (LSPM North)
  - Northern Declinations
- Same:
  - Catalog Matching
  - RPM/Color-Color cuts
  - Atmospheric Model Fitting
- New:
  - Linear Discriminant Analysis (LDA)
  - LDA Training Set (Kilic 2006)



J. N. Kutz, AMATH 582 Course notes

Revamped Target Selection
Classical Discriminate Techniques

- RPM/Color-Color Plots
  - Kilic 2006 data
- 2 measurements



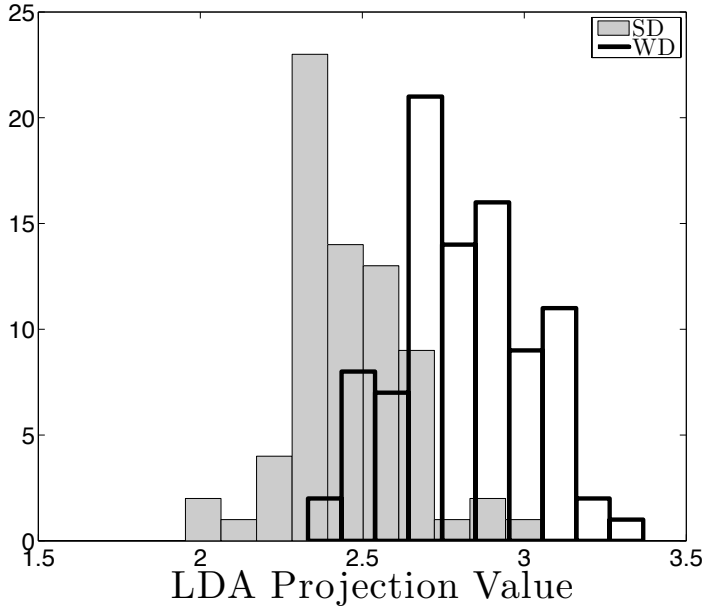
Revamped Target Selection LDA

- 2-class discrimination based on <u>all</u> measurements
- $u\ g\ r\ i\ z\ \mu$
- Construct RPM for each band, 5-D LDA
- Construct Scatter Matrices
- Solve generalized eigen problem
- Determine best projection (largest eigenvalue).
- Project targets onto LDA basis defined by the training set

$$\mathbf{S}_B = (\mu_2 - \mu_1)(\mu_2 - \mu_1)^T$$

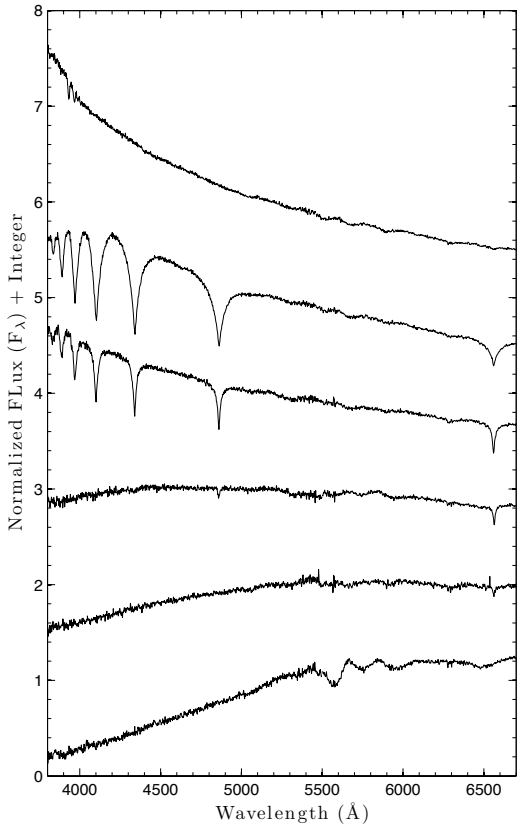
$$\mathbf{S}_W = \sum_{j=1}^{2} \sum_{\mathbf{x}} (\mathbf{x} - \mu_j)(\mathbf{x} - \mu_j)^T$$

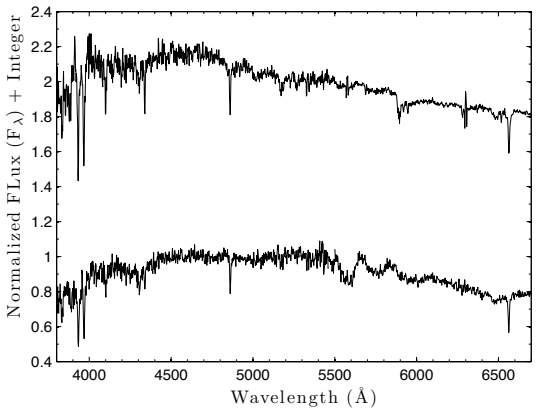
$$\mathbf{S}_B \mathbf{w} = \lambda \mathbf{S}_W \mathbf{w}$$



APO Observations

- 3.5m Telescope
  - Dual Imaging Spectrograph (DIS)
  - 6 WDs
    - 4 DA
    - 1 DC
    - 1 DZ?
  - 2 SDs
- SDSS Spectra (Freebies)
  - 18 WDs
    - 10 DA
    - 1 DQ
    - 6 DC
    - 1 DZ





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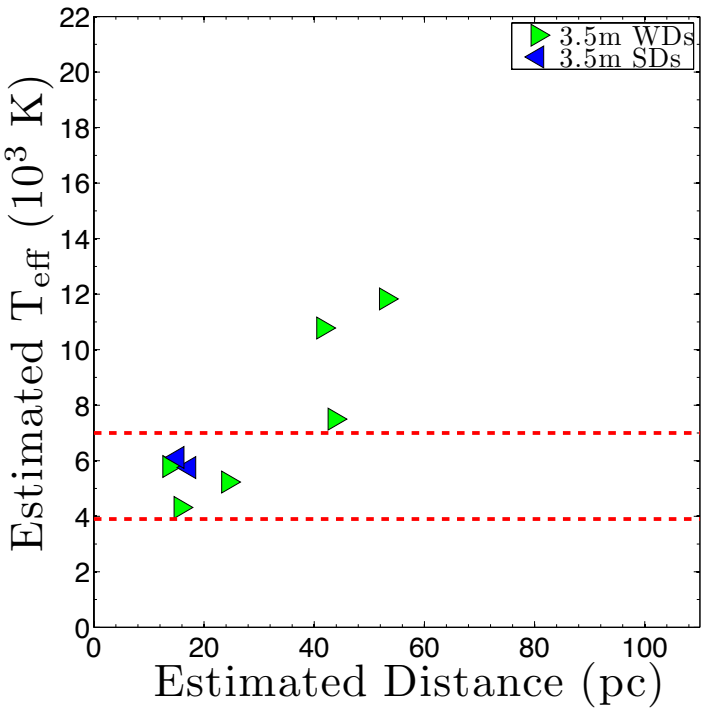
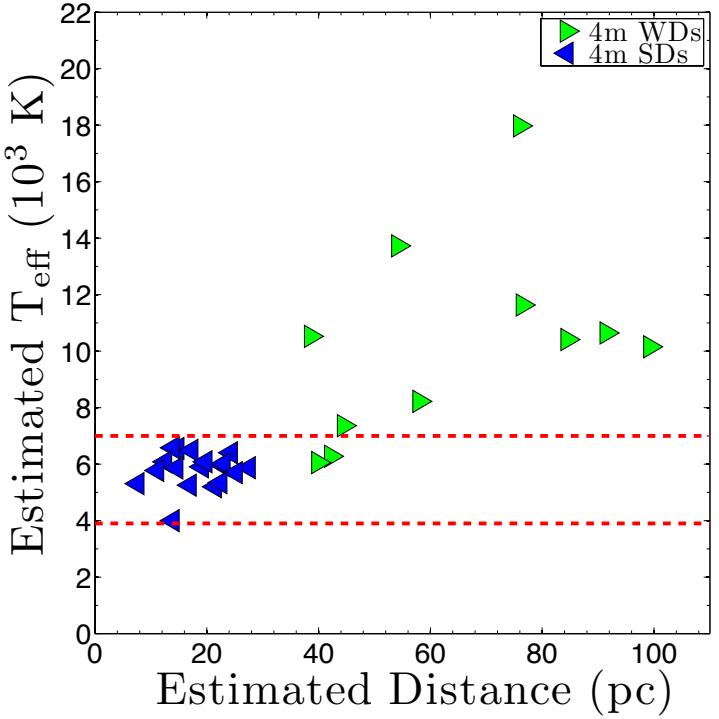
APO vs. CTIO

Quantifying SD Contamination

- Less Contaminants
- 2 targets put on CTIOPI Parallax Program:
  - -Estimates at 13.6 pc & 15.7 pc





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