INTRODUCTION AND BACKGROUND

- WDs form from smaller to intermediate mass stars like the Sun. They are the remnant core of what was once a star.
- WDs are classified based on composition and spectral patterns.
- Many white dwarf stars (WDs) have been found to be “polluted,” meaning they contain elements heavier than hydrogen and helium in their atmospheres.
- Accretion of rocky bodies is one proposed mechanism for atmospheric pollution of WDs. As rocky bodies disintegrate due to tidal forces and orbital destabilization, they leave behind a circumstellar (CS) disk of debris.
- When heated, CD disks emit excess infrared (IR) emissions.

METHODS

- Assemble target list with good coordinates. Some of these targets move significantly with time (have high proper motion)
- Obtain archival data from a variety of optical and infrared surveys: SDSS, Spitzer, WISE, DENIS, UKIDSS, PanSTARRS and 2MASS.
- Attach coordinate system (WCS) to FourStar data. Calibrate FourStar data by comparing 2MASS and FourStar measurements in the same band.
- Plot spectral energy distributions (SEDs) of archival and FourStar data along with model curves to look for large infrared excesses.
- Create multicolor (RB/RG) images of FourStar, 2MASS and WISE bands in D99 to identify likely contamination of SEDs in WISE bands due to source confusion.
- Determine significance of small IR excesses by comparing near and far IR bands (Rebull et al. 2015; Mizusawa et al. 2012 and references therein):
  \[
  X = \frac{\text{[nearIR]}}{\text{[farIR]}} - \frac{\text{[nearIR]}_{\text{predicted}}}{\text{[farIR]}_{\text{predicted}}}
  \]
  \[
  \sigma(\text{nearIR} - \text{[farIR]})
  \]

SOURCE CONFUSION EXAMPLE

SDSS J153149.04+025705.0.

Left: FourStar J image
Right: RB image of FourStar J band (red) and W1 band (blue). There are two objects where WISE sees one, this second object is likely responsible for the IR excess seen in the SED (meaning the WD doesn’t have a dusty disk).

RESULTS AND DISCUSSION

- 16 targets are identified as disk candidates, 7 of which are newly identified. Ten of these are known to be metal-rich.
- Two disk candidates have WISE excesses from source confusion (but the remaining data are uncontaminated).
- 9 targets have IR excesses, likely attributed to a brown dwarf (BD) companion, 6 of which are newly identified.
- 9 targets have IR excesses primarily in WISE, which are likely due solely to source confusion.
- 30 candidates do not appear to have IR excesses; their fluxes are well-matched to the model.
- 2 targets determined to be M dwarfs (not WDs), thus dropped from additional analysis.

DISK CANDIDATE EXAMPLE

161717.04+162022.3
DA WD; periodically enriched?

This target is identified as a disk candidate through spectroscopic time series data (Wilson et al., 2014). Ca emissions were detected in 2008 that then faded, thought to be the result of an impact of a planetesimal with the debris disk that then accreted onto the WD and gravitationally settled.

The SED confirms an excess as FourStar and WISE data are above the model; no source confusion is present in the imaging.

REFERENCES CITED