Motivation

• Groups are the building blocks of clusters and the place where *preprocessing* takes place.

• Structure, kinematics, morphological content, star formation activity are indicators of the evolutionary stage of a group.

• Dwarf members are the most vulnerable to pairwise interactions and to environmental effects (tidal encounters, gas stripping etc.)
NGC 6962 group

- Relatively rich group with ~40 group members.
- It shows a core (0.73 Mpc) – halo (2.6 Mpc) structure.
- It shows a density-morphology and density-SF activity segregation.
- Probably a partially relaxed group.

\[ D \approx 60 \text{ Mpc} \]
NGC 6962 group

- Relatively rich group with ~40 group members.
- It shows a core (0.73 Mpc) – halo (2.6 Mpc) structure.
- It shows a density - morphology and density - SF activity segregation.
- Probably a partially relaxed group.
**NGC 5005/5033 group**

- Loose group, contains ~45 galaxies within 1.5 Mpc.
- Late type-dominated group, with many star-forming dwarf galaxies.
- Consists of several kinematically distinct subgroups.
- **Probably a dynamically young group.**

$D \approx 15$ Mpc
NGC 5005/5033 group

- Loose group, contains ~45 galaxies within 1.5 Mpc.
- Late type-dominated group, with many star-forming dwarf galaxies.
- Consists of several kinematically distinct subgroups.
- Probably a dynamically young group.
Results

• 4 new dwarf members added to the NGC 6962 group.
• 2 new dwarf members added to the NGC 5055/5033 group.
• Spectroscopic follow-up ongoing...
Vennik & Hopp: How they found their sample

- **NGC 6962 group**
  - 60 Mpc distant
  - Search area within 1 Mpc of central galaxy

- **NGC 5005/5033 group**
  - 15 Mpc distance
  - Search area within 1.5 Mpc of two bright central galaxies
Vennik & Hopp: How they found their sample

- Extraction from the PhotoObjAll catalog based on:
  - surface brightness $> 22.0 \text{ g/arcsec}^2$
  - light concentration $C = \text{petroR50/petroR90} > 0.4$
  - size $\text{iso}_A > 15 \text{ arcsec}$ (isophotal major axis, measured in pixels)
  - We assumed type “Galaxy”
  - "All pre-selected dwarf candidates have been visually inspected . . . final classification has been made on their morphological and colour grounds."
Vennik & Hopp: How they found their sample

NGC6962
SELECT o.objid, o.type,o.ra,o.dec, o.flags,(o.g+o.rho) as mu,
    (o.petroR50_r/o.petroR90_r) as C, isoA_r,
o.modelMag_u,o.modelMag_g,o.modelMag_r,o.modelMag_i,o.modelMag_z
FROM PhotoObjAll as o
WHERE
    (o.g+o.rho) > 22.0
    and (o.petroR50_r/o.petroR90_r) > 0.4
    and o.isoA_r > 37
    and o.ra > 310.8 and o.ra < 312.83
    and o.dec > (-0.68) and o.dec < 1.32
    and o.type < 4
    ;and (o.flags & (dbo.fPhotoFlags('SATURATED'))) = 0
ORDER BY mu

NGC5005
    and o.ra > 191.7 and o.ra < 204.4
    and o.dec > 30.5 and o.dec < 43.0
Their Sample

- **NGC 6962 group**
  - Find it to be very rich
  - 29 probable (44 possible) members within 1 Mpc

- **NGC 5005/5033 group**
  - Find it to be relatively sparse
  - 8 probably (5 possible) members within 1.5 Mpc
What we found

- **NGC 6962 group**
  - 29 probable (44 possible) members within 1 Mpc
  - Around NGC6962, we found 279 candidates when we eliminated objects with the "Saturation" flag, or 555 without doing that. This was enough to look at every single one, which turned into our first hint that something wasn't right.

- **NGC 5005/5033 group**
  - 8 probable (5 possible) members within 1.5 Mpc
  - Around NGC5005/5033, we found 7331 candidates without using the saturation flag when we searched using r-band, or closer to 18,000 when we used the i-band.

- We find it difficult to believe that anyone would think "manual inspection" of all of these candidates would be a smart way to identify galaxies.
- They found *very few* objects in 5005/5033 out of many candidates, and found many objects in 6962 out of very few candidates.
What they *could* have found

- **Case #1: NGC6962**
  - Candidates: 279
  - They claim: 29 probable, 44 possible
  - We find from their query: 5
  - And in our best possible attempt we find: 19
  - Running a SpecObj query finds: 20 candidates

- **Case #2: NGC5005/5033**
  - Candidates: Thousands
  - They claim: 8 probable, 5 possible
  - We find from their query: 15 with a measured SDSS redshift indicating they're at the distance of this group, and another 5 in the background at a redshift of 2400 km/s.
  - And in our best possible attempt: We would have just run a query on the SpecObj database, where we would have found 69 candidates, resulting in ~20 galaxies not found by our method
What they *missed*

- **Case #2: NGC5005/5033**
  - They claim: 8 probable, 5 possible
  - We find: 15 with a measured SDSS redshift, and another 5 in the background
  - SpecObj database: 69 candidates, resulting in ~20 galaxies not found
SpecObj Query

- SELECT TOP 5000 s.specobjid, s.z, s.bestobjid
  FROM SpecObj as s
  WHERE
    s.ra > 310.8 and s.ra < 312.83
    and s.dec > (-0.68) and s.dec < 1.32
    and s.z > 0.01 and s.z < 0.017
  ORDER BY z
A Better Query?

- Include a search on structural parameters
  - Dwarf galaxies are well described by exponential light profiles
- Less than 10% contribution from deVaucouleur’s to best composite model
- Exponential scale length > 1.5”
A Better Query?

SELECT o.objid, o.type, o.ra, o.dec, o.flags, (o.g + o.rho) as mu, (o.petroR50_r/o.petroR90_r) as C, isoA_r, o.modelMag_u, o.modelMag_g, o.modelMag_r, o.modelMag_i, o.modelMag_z
FROM PhotoObjAll as o
WHERE
  (o.g + o.rho) > 22.0
  and (o.petroR50_r/o.petroR90_r) > 0.4
  and o.isoA_r > 37
  and o.ra > 310.8 and o.ra < 312.83
  and o.dec > -0.68 and o.dec < 1.32
  and o.type < 4
  and o.expRad_g > 1.5
  and o.fracDev_g < 0.10
  and (o.flags & (dbo.fPhotoFlags('SATURATED'))) = 0
ORDER BY mu
A Better Query?

• NGC5005
  – 1498 total entries returned
  – Of Ann’s 20 objects with spectra, 19 returned
  – Of 6 candidates w/out spectra, 2 returned

• NGC6962
  – 59 total entries returned
  – 3 of Ann’s 5 returned
  – 2 of the 19 identified by eye returned
Missed Objects

NGC6962: Knot at edge of galaxy identified

NGC5005: Bright knot (with spectrum) identified in LSB galaxy
The Real Problem

• Photometry!
  – If good photometric properties, likely a spectrum also

• Sloan pipeline has known problems with extended and LSB sources
  – “Galaxy shedding”: break a galaxy into multiple pieces

• How to find LSB galaxies?
  – Kniazev et al. 2004
Finding LSB/dwarf candidates

• List of known LSB galaxies
  – Up to 30% missed when searching database
  – Relaxed search parameters lead to many false detections

• Need a detection method separate from SDSS pipeline
  – Work with images directly (combine g,r,i)
  – Filtering/smoothing essential for detecting
    • For $\mu > 23$, 42% of test galaxies detected only after filtering
Conclusions

• It’s not easy to find dwarfs with an SDSS SQL query
  – But it becomes easier when you can narrow in on a particular location/redshift range.
• Structural parameters can improve things, but the SDSS pipeline is never going to be optimized for LSB galaxies.