Calibration of *SPHEREx*

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Calibration goals

- **Relative**: Can compare two measurements at the same wavelength but different times and spatial positions.
- **Absolute**: Can compare two measurements of the same object but at different wavelengths
- *one of these is far easier than the other*

SDSS history

- Self-calibration replaced all other calibration programs by *SDSS DR8*.
- Made use of **redundancy**: Same sources hit multiple detector locations.
  - Only barely: The *SDSS* was a single-pass survey.
  - Discovered severe flat-field issues with sky flats!
  - Structured the problem as a **convex optimization**.
- It exceeded all requirements.
- However, it could not deliver absolute calibration; each of the 5 bandpasses was tied to Gunn photometric standard BD+17.

Relative calibration requirements

- **Redundancy**: Same source observed at different detector positions, different times, different detector illumination histories.
- This comes for free in *SPHEREx*.
- Sources near the ecliptic poles are especially valuable.

Show-stoppers for relative calibration

- I don’t see any show-stoppers for *SPHEREx*:
  - Variable sources
  - Hysteresis (6-month repeats are relevant here)
  - Cosmic rays
  - Bad pixels
  - PSF variation with position and wavelength.
- All of these are fine, as long as there is redundancy along relevant directions.
- It might not be possible to model the Zodi.
  - (but that probably doesn’t matter)
- *SPHEREx* is **optimally designed for relative calibration**.

Absolute calibration ideas

- *[null]*

Absolute calibration ideas

- White dwarfs?
- Quasar twins at different redshifts?
- LRGs at different redshifts, plus an evolutionary model?
- Fly a calibration source?
- Asteroids / solar reflectors?