Photometry and Proper Motions of M, L, and T Dwarfs from the Pan-STARRS1 3π Survey

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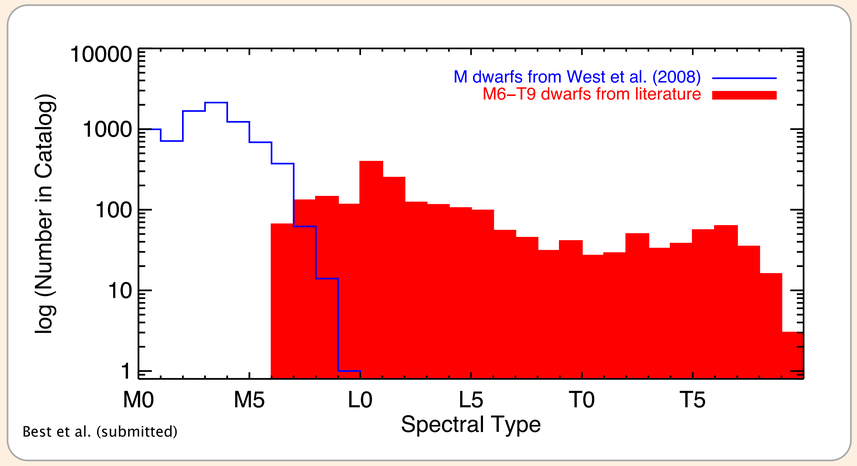
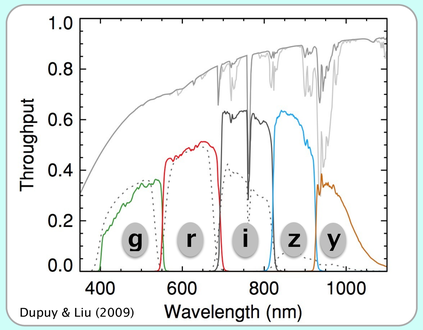
Our Catalog

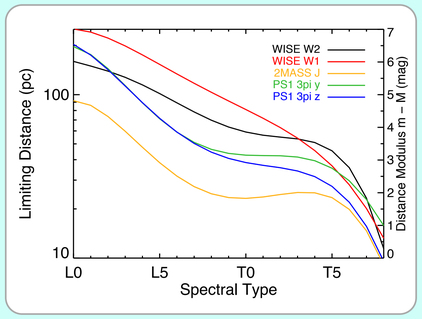
- 9,938 M/L/T dwarfs.
- Photometry from PS1, 2MASS, and AllWISE.
- PS1 detections and matches in 2MASS & AllWISE carefully vetted.
- Astrometry in Gaia DR1 reference frame.
- Identifies young objects, binaries, subdwarfs.
- Electronic tables available at tinyurl.com/PS1-MLT-dwarfs



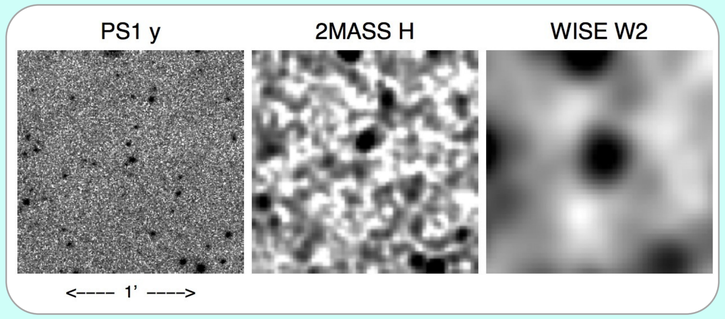
The Pan-STARRS1 3π Advantages



- **Coverage**: 3/4 of the sky (≈31,000 deg²).
- **Multi-band**: 5 optical *grizy* filters (left — dotted gray lines = SDSS *griz* bands).
- **Multi-epoch**: 12 epochs per band over 4 years ⟶ proper motions + parallaxes.
- **Red sensitivity**: Greater depth for L and T dwarfs (bottom left) than 2MASS and SDSS.
- **Angular resolution**: Median PS1 ≈1.1" (below, compare 2MASS ≈2.5", WISE ≈6").



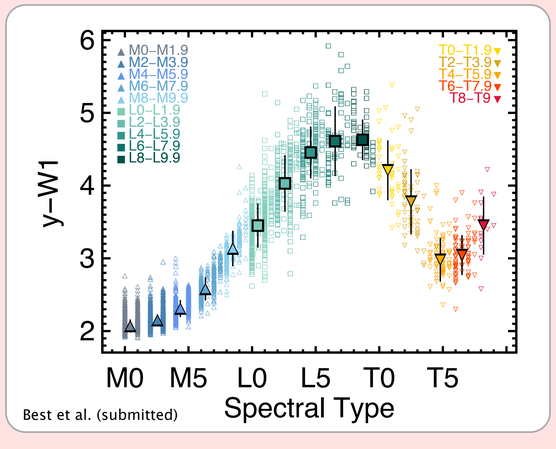
PS1 is deeper than 2MASS for L and T dwarfs.

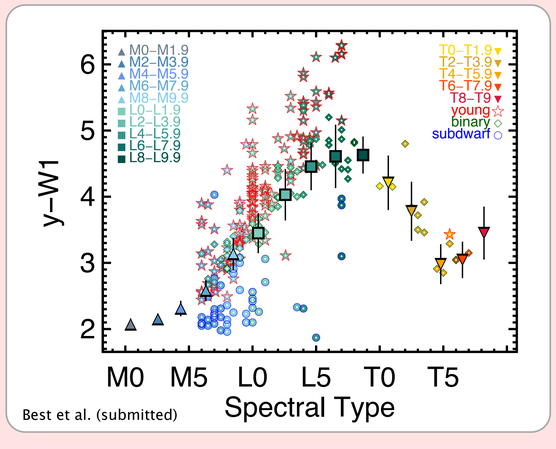


Images of the T1.5 dwarf PSO J272.0887-04.9943 in PS1, 2MASS, and WISE, demonstrating the superior angular resolution of Pan-STARRS.

Photometry from optical to mid-IR

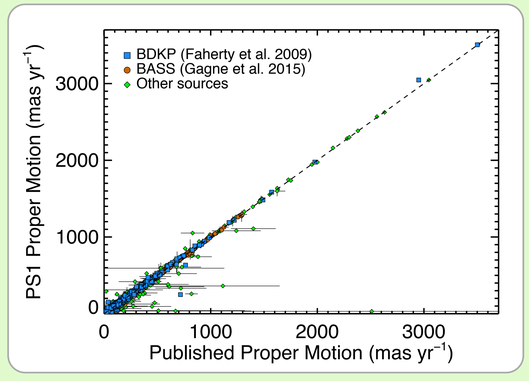
- 12 bands: grizy (PS1), JHK (2MASS), W1W2W3W4 (AllWISE)
- We determine median colors and SEDs spanning g_{P1} to W3 (0.55–12 μm).
- We highlight colors of young objects, binaries, and subdwarfs.

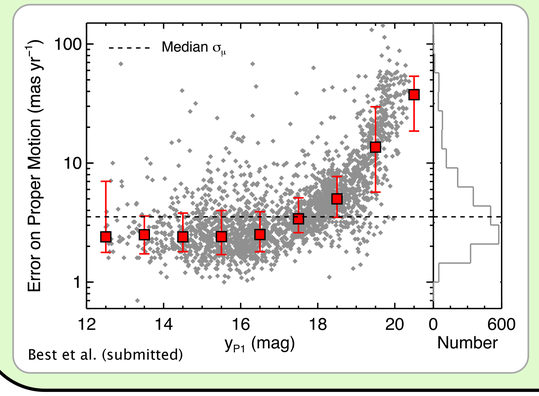




Example from our catalog: y–W1 v. SpT. Left: Normal field objects (no young objects, binaries, or subdwarfs), with median colors plotted using large symbols. Right: Young objects (red stars), binaries (green diamonds), and subdwarfs (blue circles) overplotted with the median colors for the normal field objects.

Proper Motions





- Includes largest set of proper motions for confirmed M6–T9 dwarfs (2,394 objects) to date.
- 409 M6–T9 dwarfs with no previous proper motions.
- Calculated using all PS1 epochs + 2MASS + Gaia DR1 (typically 50–90 epochs spanning 13–17 years).
- Median error = 3.5 mas/yr (bottom plot: red symbols show median errors for bins of 1 mag).