Planet-Finding Candidate Stars in Solar Neighborhood

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Abstract

Discoveries of more than 100 Jupiter-class planets in the past decade provide a good data base for investigation and characterization of extra-solar planets. The space-based mission, such as SIM, TPF and Darwin etc, will open a new frontier to determine masses of extra-solar planets , to imaging them directly, and more important, to identify habitable planets. Because of limitation of instrument sensitivity and resolution it is necessary to investigate candidate stars in solar neighborhood for search of planets with and without life. This work presents statistical analysis of planet-finding candidate stars. In particular, spectral distributions, binary frequencies, luminosity calibrations, and distance distributions are studied for potential objects with planets. Although more than 97extra-solar planets discovered so far are rotating around main-sequence stars, three of G, K giants do have planetary companions. Study of non-dwarf stars with possible extra-solar planets is conducted. The diversity of extra-solar planets is critical to develop a theory of planet formation and evolution.

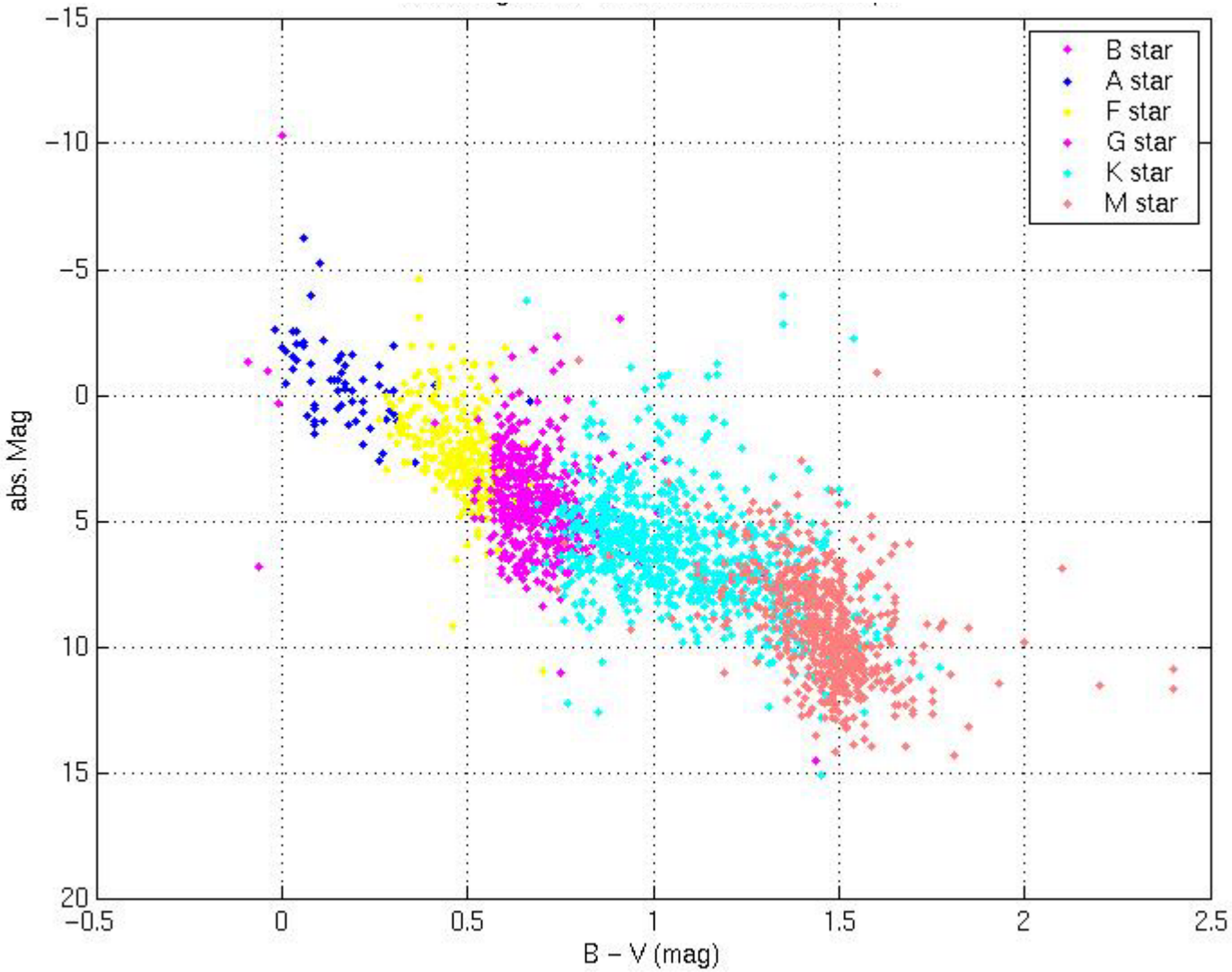
Characteristics of Current Exoplanets

- Total exoplanet systems are about 108
- G dwarfs = 69, K dwarfs= 18,
  F dwarfs = 14, M dwarfs = 2
- 1 G giants, 4 K giants
- Large eccentricities, most e =0.3~0.7
- Large mass, 1– 3 Jupiter masses
- Very close distance, most 0.02~1AU

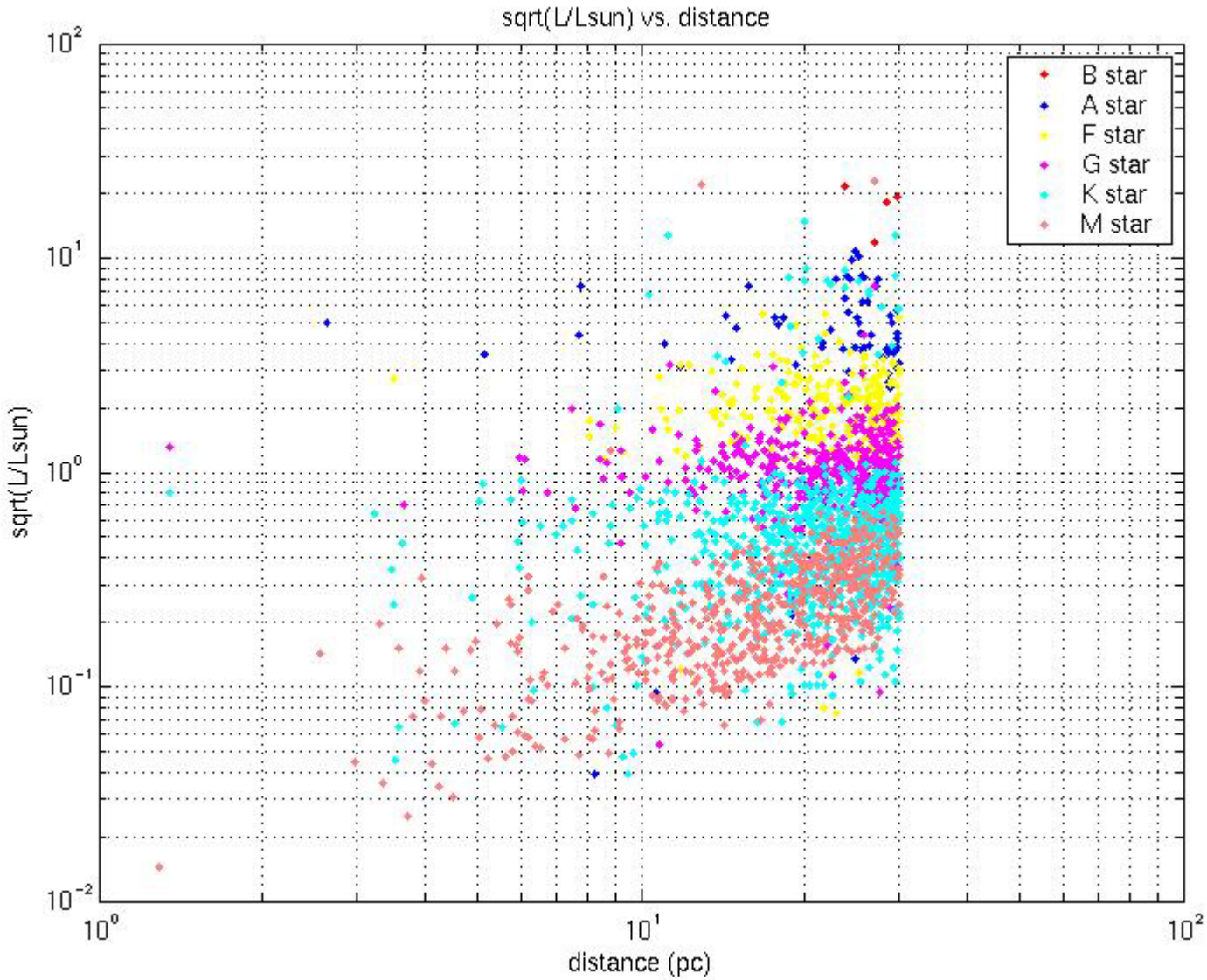
Why need G & K Giants

- Five giants have planets already
- Understanding of formation of star-planets systems
- Search planets around stars with mass of 1—3 M⊙ for short lifetime disks
- Validate theory of the disk instability for planet formation

H-R Diagram for stars with distance < 30 pc



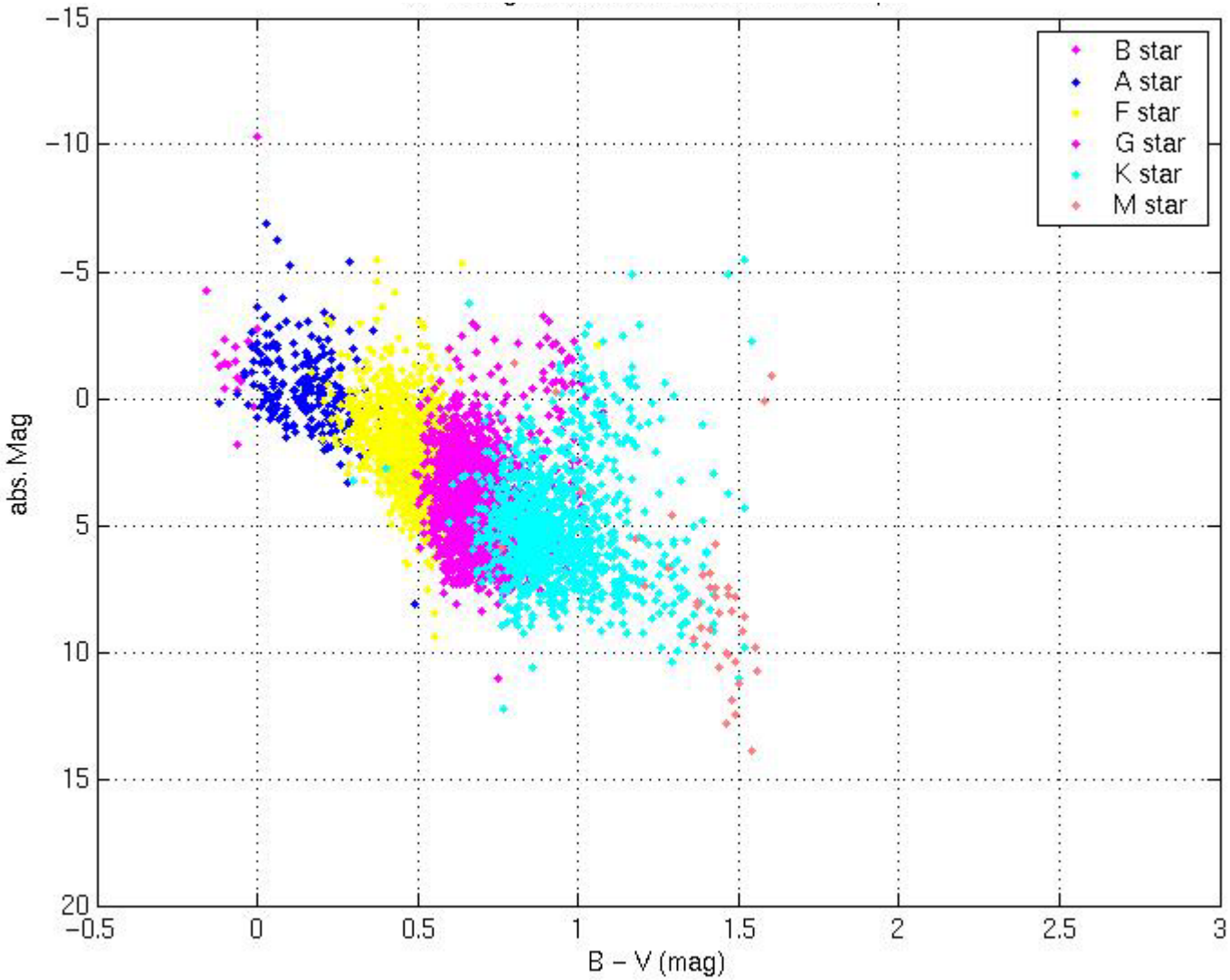
Candidate stars with distance < 30 pc



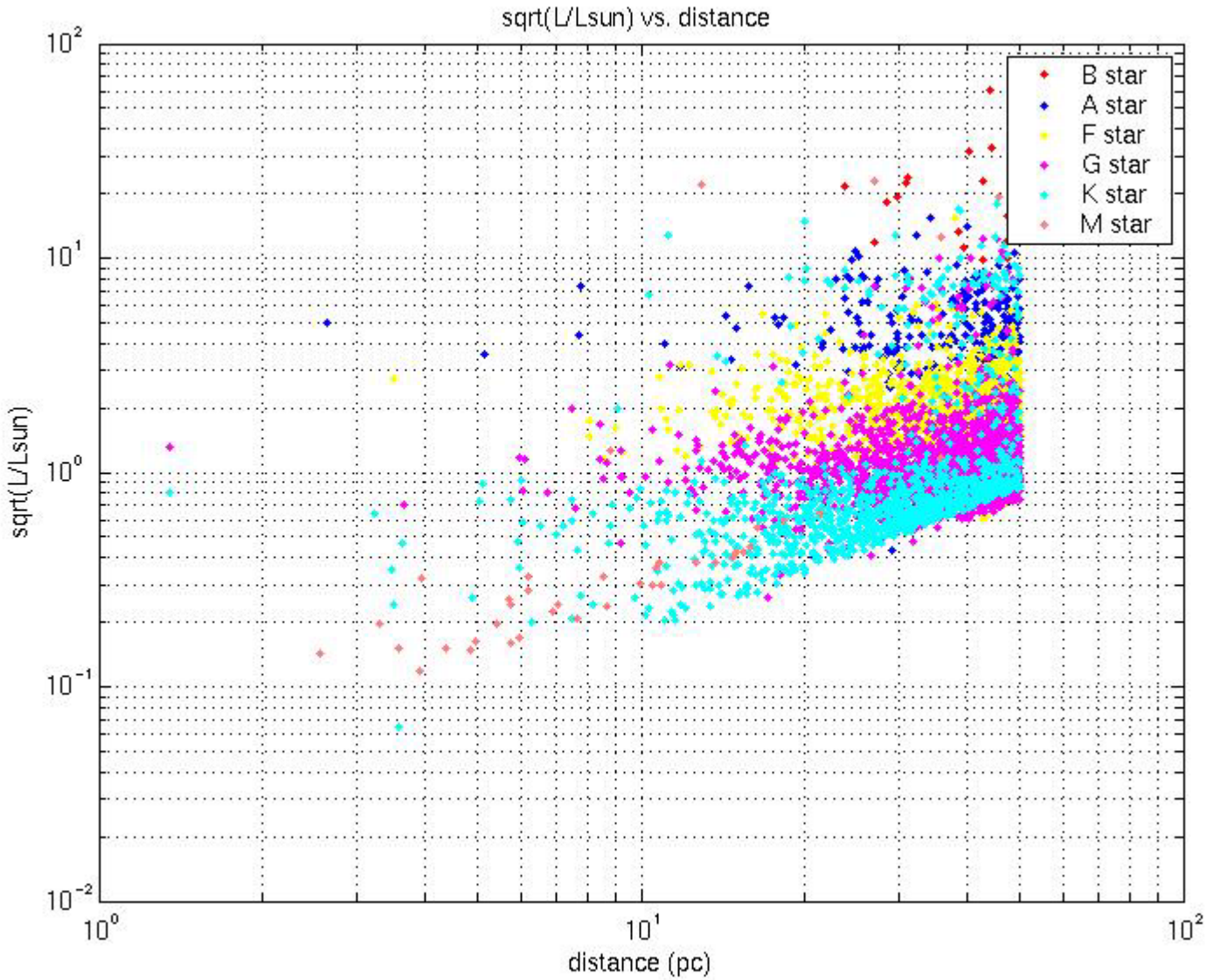
Statistics of Candidate Star Distributions

	B	A	F	G	K	M	total
<30pc	5	66	263	440	790	577	2141
<50pc	20	244	1178	1925	2267	852	6487
<50pc noBina	14	156	882	1524	1743	625	4945
<50pc <9mag	19	236	1157	1841	1082	40	4375

H-R Diagram for stars with distance < 50 pc



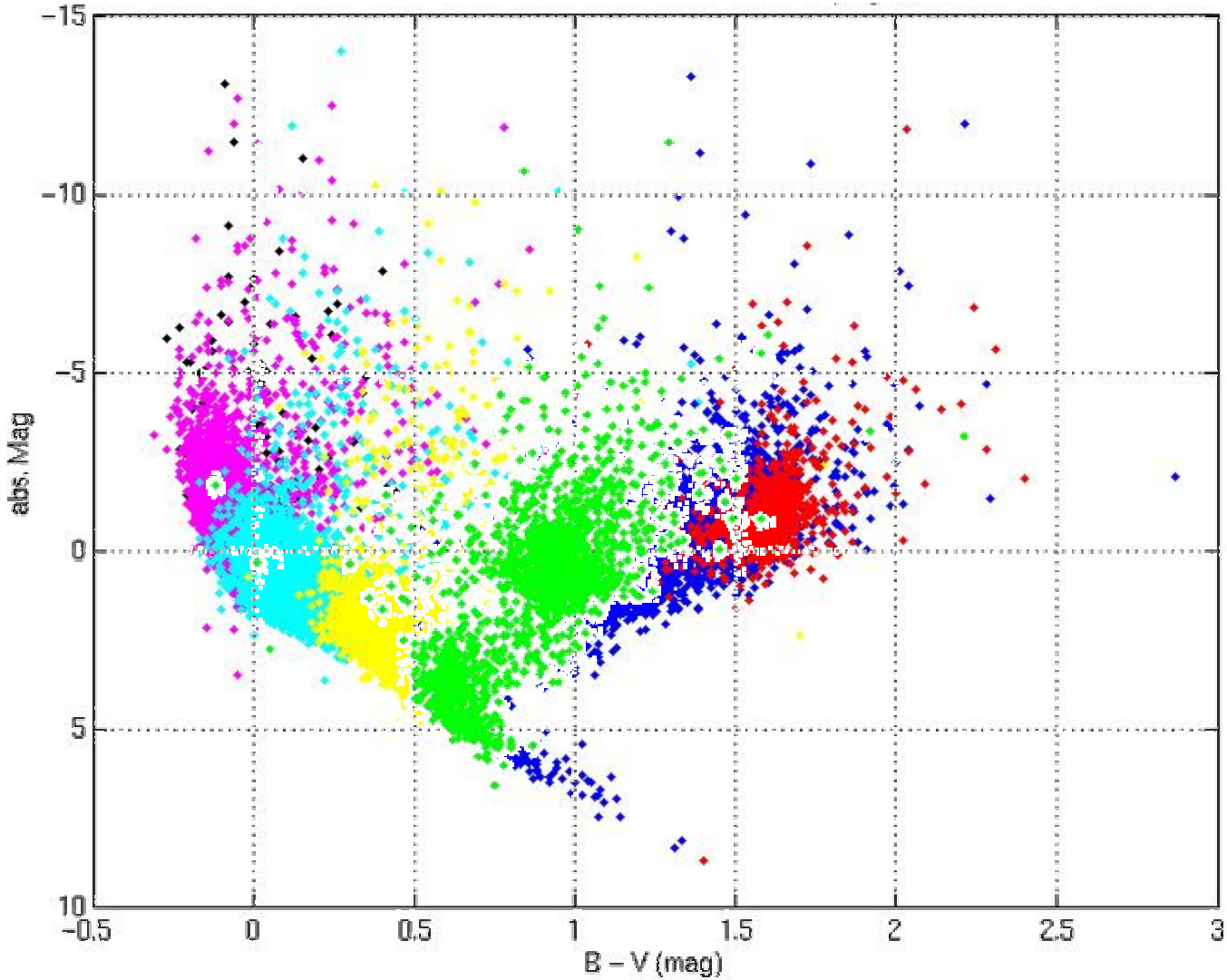
Candidate stars with magnitude < 9



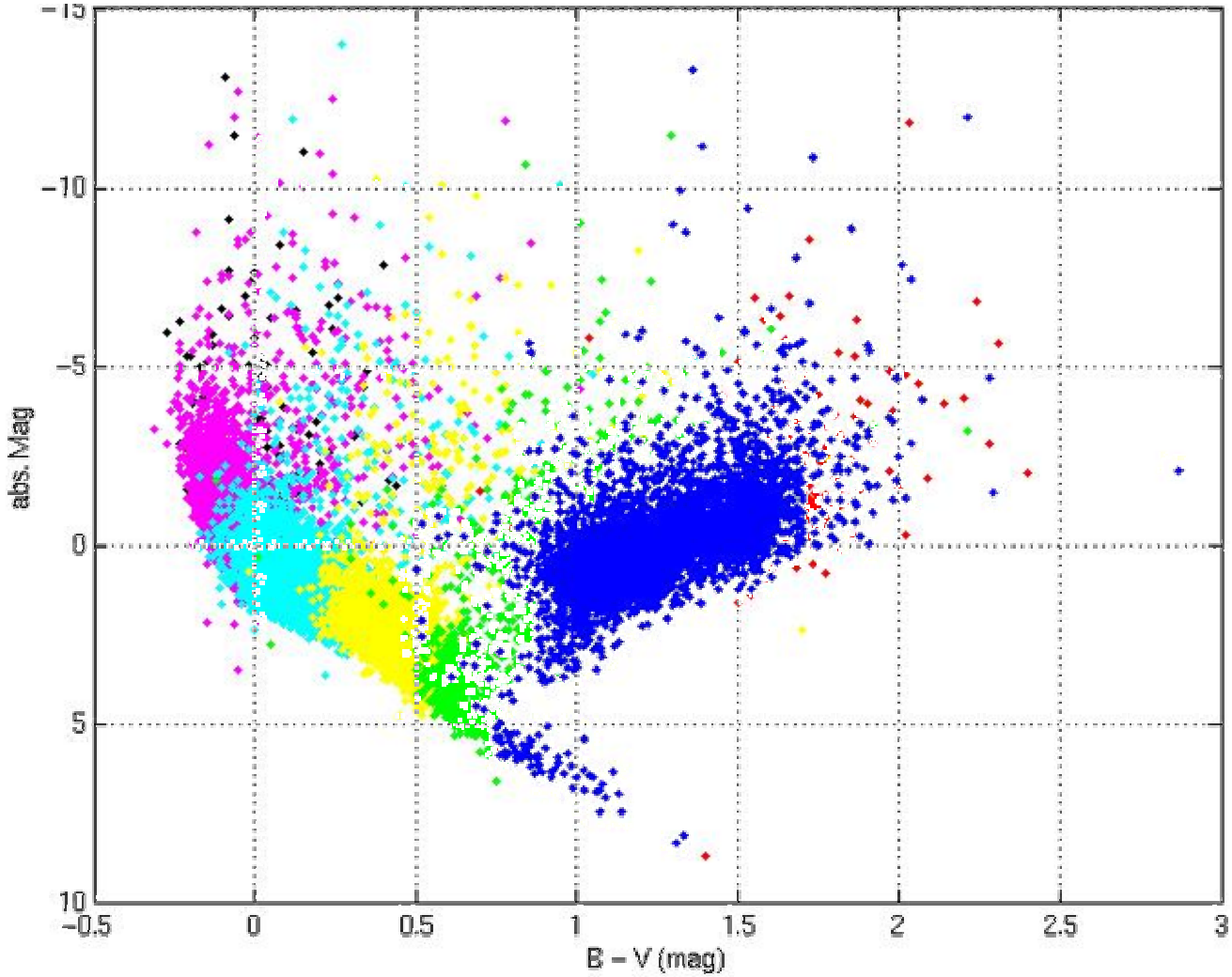
Statistics of Dwarfs and Giants (< 7mag)

	O	B	A	F	G	K	M	Total
MS	25	2649	3425	2406	618	170	2	9295
Giants	51	80	100	130	1589	4873	894	7717
Total	76	2729	3525	2536	2213	5043	896	17012

G stars (<7 mag) on H-R Diagram



K stars (<7 mag) on H-R Diagram



K stars

Conclusions

- More F, G and K dwarfs than giants in the solar neighborhood, M dwarfs are rare
- Giants and subgiants are good candidates for testing theory of exoplanet formation
- Need multiple techniques to exam exoplanet candidates.
- Binary stars are the majorities, and are the major difficulties for cleaning