Variable Stars from the SDSS-II Supernova Survey

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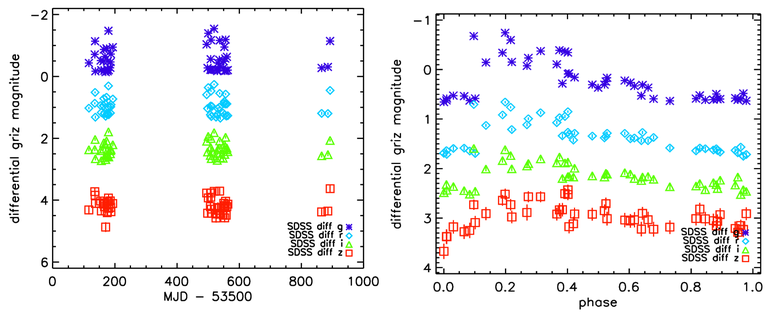
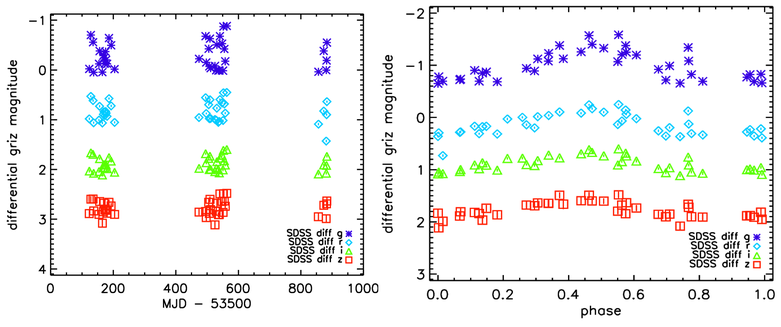
Periodic Variables – I

griz differential mag. LCs – SN Survey (left) and phase-folded (right)

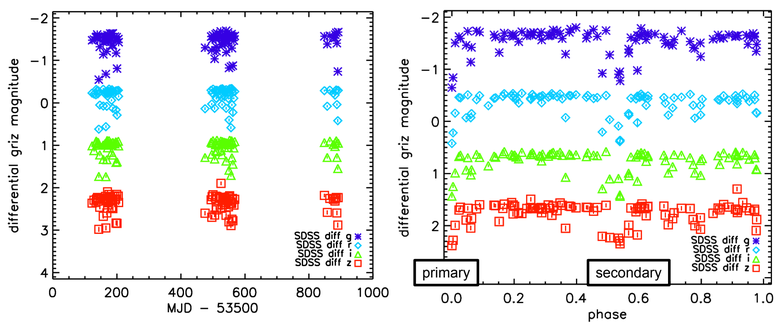
RR Lyrae candidate SDSS J223745.63-002531.9, period ~ 0.628 days



RR Lyrae candidate SDSS J214158.90-000731.3, period ~ 0.781 days



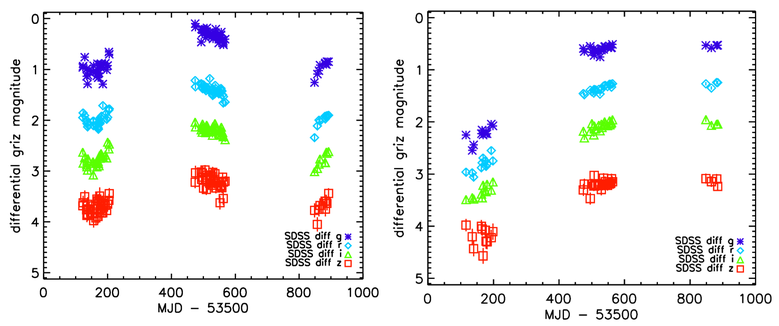
G/K-dwarf EB candidate SDSS J030753.51+005012.9, period ~ 2.92 days



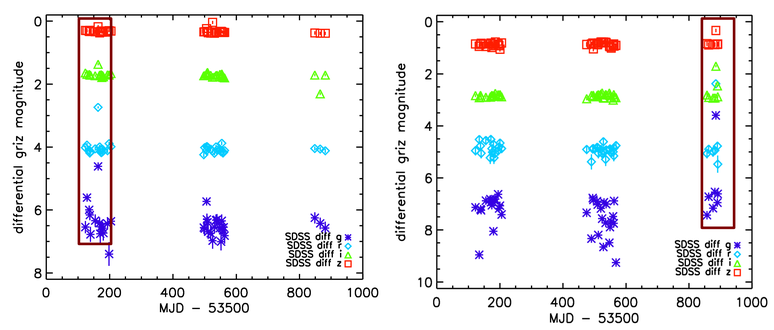
Other Variables – I

griz differential mag. LCs from the SN Survey

LPV candidates SDSS J000529.31+010259.7 & SDSS J004719.26-010141.8



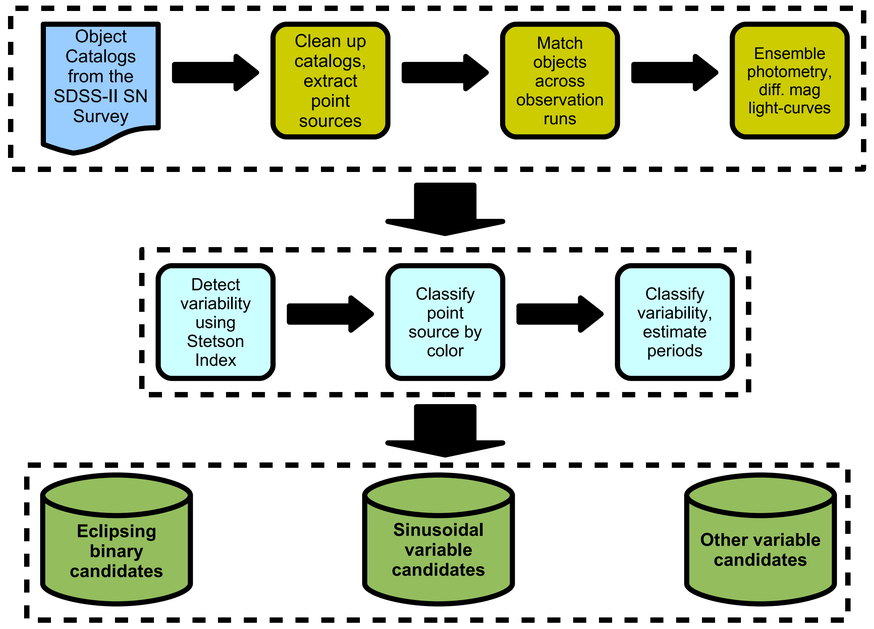
Flare stars SDSS J000940.18+003849.9 & SDSS J010938.59-002232.3



Summary

The SDSS-II Supernova Survey is a multi-epoch, multi-color photometric survey covering 300 sq. deg. of sky (RA between 22 h & 4 h, DEC between -1.25° & +1.25°) intended to discover SNe Ia. We used the publicly available calibrated object catalogs from this Survey to generate differential magnitude light-curves of ~1.1 million point sources, classifying objects by color and by the type of their variability. As of December 2008, we have identified ~1,600 candidates for variable point sources, the majority of which appear to be QSOs (see the table below for details). By the end of our processing, we expect to have ~2,000 variable point sources: a large and uniform sample that will be of great use in studying these objects' properties, especially in the time-domain.

Processing Pipeline



Finding Periods

We used three string-length methods to estimate periods from the sparse and unevenly sampled light-curves obtained from the SDSS-II SN Survey. The first is the original Lafler-Kinman (1965) method, which attempts to minimize the dispersion of magnitude measurements ordered in phase for a test period, thus yielding the 'smoothest' possible light-curve. The other two are variations on this theme; the Dworetsky (1983) method corrects for different units used for magnitude and phase measurements, and the Stetson (1996) method takes into account the errors in each magnitude measurement. We also used the Lomb-Scargle periodogram as outlined by Scargle (1982) and elaborated upon by Horne (1986), as an independent estimate of the period. We cannot use more sophisticated period-finding algorithms such as AoV (Schwarzenberg-Czerny 1996) and BLS (Kovacs 2002) because these involve binning consecutive magnitude measurements in phase, and are best suited for light-curves with many more measurements than we have from the SN Survey.

Results

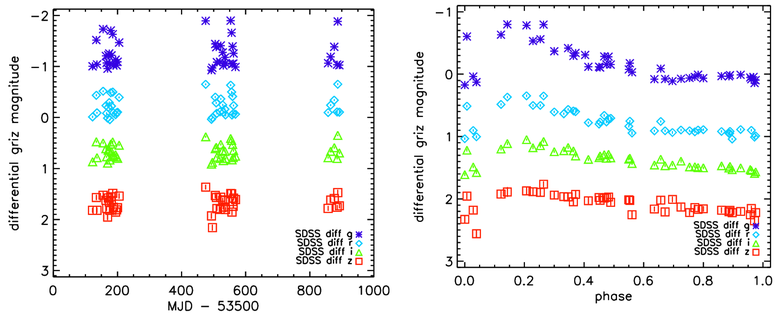
Total point sources with ≥ 10 detections	1,151,884
Processed point sources (December 2008)	543,099
Probable variable point sources	1,624
QSO candidate	793
RR Lyrae candidate	56
Cataclysmic variable candidate	3
White-dwarf	3
Main-sequence + white-dwarf	6
AGB	3
Low-metallicity	56
A/BHB	37
F-turnoff/subdwarf	139
F/G	292
K-dwarf	44
K-giant	33
M-dwarf	149
Other (mostly faint blue)	254
Probable variable M-dwarfs	149
Eclipsing binary candidate	52
Flare star	22
Other	40
Unknown	34

OBJECT CLASSIFICATION: Objects were first classified by type based on target selection algorithms used by the SDSS-II SEGUE survey and color-cuts defined by West et al. 2005 for M-dwarfs. Next, the QSO and white-dwarf candidates were identified by cross-matching objects to the SDSS Quasar Catalog (Schneider et al. 2007) and the SDSS white-dwarf catalog (Eisenstein 2006), respectively. Finally, the RR Lyrae and cataclysmic variable (CV) candidates were identified using color cuts by Sesar et al. 2007 and Silvestri et al. 2006, respectively.

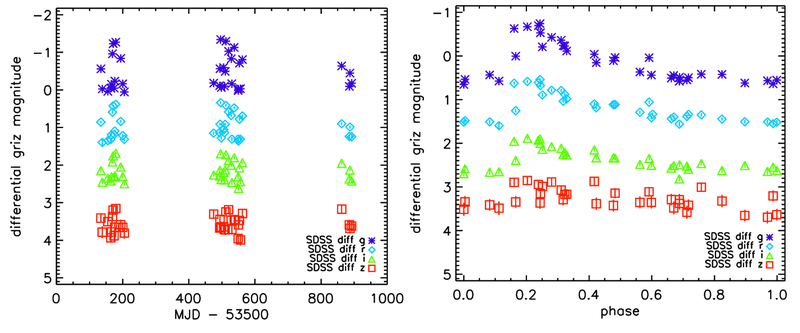
Periodic Variables – II

griz differential mag. LCs – SN Survey (left) and phase-folded (right)

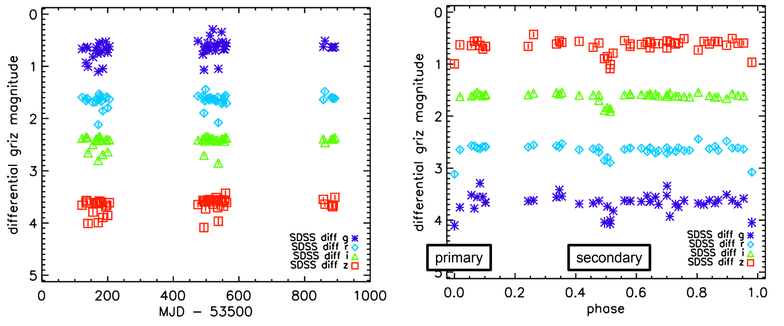
Cepheid candidate SDSS J224012.11-001512.5, period ~ 1.42 days



Cepheid candidate SDSS J233949.32-001634.6, period ~ 1.14 days



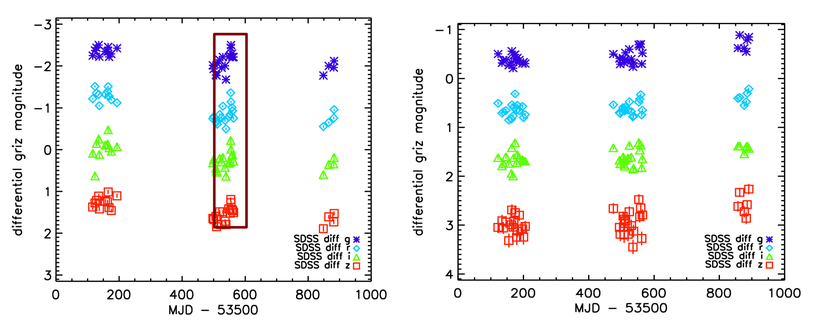
M-dwarf EB candidate SDSS J000557.61+005246.2, period ~ 2.14 days



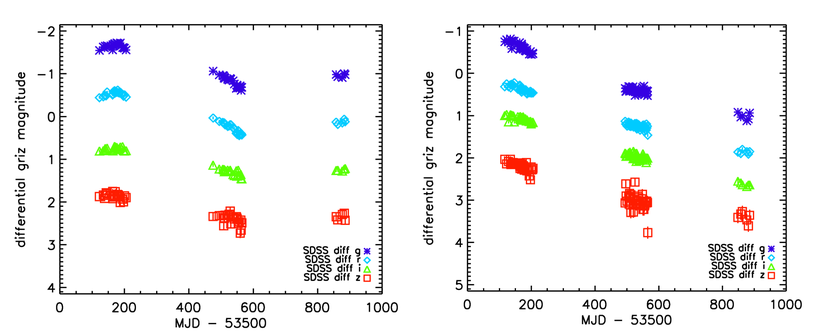
Other Variables – II

griz differential mag. LCs from the SN Survey

CV candidates SDSS J230351.63+010651.1 & SDSS J0223322.60+005059.5



QSO candidates SDSS J025515.09+003740.5 & SDSS J025602.56+005255.4



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