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59 NEW VARIABLE STARS FROM SAVS SKY SURVEY

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We present 59 new variable stars discovered by the Semi-Automatic Variability Search sky survey (Niedzielski et al. 2003) operating at the Astronomical Observatory of the Nicolaus Copernicus University in Piwnice, near Toruń. Photometric data were collected with the semi-automatic telescope equipped with a 135/2.8 telephoto lens and SBIG ST-7XE CCD camera with KAF-0402ME chip. Observations were collected between September and December 2004 while monitoring 8 fields (each $2^\circ \times 3^\circ$ wide) covering 48 square degrees at the boundary of constellations of Pegasus and Andromeda ($23^{\text{h}}27^{\text{m}}30^{\text{s}} < \alpha < 23^{\text{h}}56^{\text{m}}30^{\text{s}}$ and $+29^\circ < \delta < +37^\circ$). About 9,600 stars brighter than 14.5 mag were observed in near-Johnson V band in total. The list of observed fields, detailed hardware specification and description of data reducing software as well as original data are available on survey's web site <http://www.astri.uni.torun.pl/~gm/SAVS>.

The list of the new regular variable stars is presented in Table 1. Their phased light curves in V band are shown in Figure 1. The long-term variables are listed in Table 3 and their light curves are displayed in Figures 2 and 3. The stars, for which variability type cannot be resolved with our photometric data (mostly long-term, red irregular or semi-regular variables), were classified as “miscellaneous” and marked with MISC in Table 3. The original photometric data are available from the survey's web site.

For several of the new variables, listed in Table 2, additional spectral observations were performed with the 0.9m Schmidt-Cassegrain telescope equipped with the Richardson spectrograph and a Wright CCD camera. Using the 600 gr/mm grating we obtained spectra between 3800 and 5800 Å with 2 Å/pix reciprocal dispersion. These spectra, after standard reduction performed with IRAF¹ were used for spectral classification.

The spectra used for spectral classification are presented in Figures 4 and 5 for early and late spectral types star, respectively. Most characteristic spectral features used for classification are indicated.

Reference:

Niedzielski, A., Maciejewski, G., Czart, K., 2003, *AcA*, **53**, 281

¹IRAF is distributed by the National Optical Astronomy Observatories, which are operated by the Association of Universities for Research in Astronomy, Inc., under cooperative agreement with the National Science Foundation.

Table 1. List of new regular variables. *SAVS ID* – identifier consisted of Right Ascension and Declination of a star calculated for J2000.0, *Other ID* – cross-identification with other catalogs, m_V – observed maximal brightness in near-Johnson V band, Δm_V – amplitude of variation, P – period of variation in days, T_0 – time of primary minimum for eclipsing binary systems or time of maximum for periodic pulsating variables (in Heliocentric Julian Days), *Type* – type of variability.

SAVS ID	Other ID	m_V	Δm_V	P [days]	T_0 [HJD]	Type
233103+355546	GSC 2777-1366	11.14	0.26	1.629275	2453258.417607	EB
233409+341854	GSC 2774-1779	12.10	1.10	3.917881	2453263.483003	EA
233416+363957	GSC 2778-1851	12.86	0.40	0.364527	2453255.339741	EW
233709+303713	GSC 2766-1184	12.04	0.56	0.801886	2453255.587692	EW
233710+313611	GSC 2766-775	13.36	0.78	0.375736	2453254.587540	EW
233827+363450	GSC 2778-1326	11.68	0.15	0.395043	2453254.414478	EW
234042+340240	GSC 2774-126	13.11	0.28	1.877176	2453259.421076	EW
234114+352438	GSC 2774-453	12.85	0.41	0.798466	2453254.471528	EB
234350+354920	–	13.30	0.39	0.340714	2453256.520397	EW
234413+320523	GSC 2771-945	11.95	0.10	0.347764	2453255.395819	EW
234520+323958	GSC 2771-807	12.15	0.13	0.813644	2453255.772549	EW
234521+340821	GSC 2775-1107	11.12	0.28	0.354665	2453255.350226	EW
234819+344833	GSC 2775-1188	11.43	1.37	1.429164	2453258.051395	EA
234823+361839	GSC 2779-288	9.93	0.49	2.588628	2453260.757154	EA
235439+364516	GSC 2780-2053	10.03	0.21	0.367193	2453256.092084	EW
235630+362854	GSC 2780-1969	12.00	0.48	2.498501	2453258.369159	EA
233204+322755	GSC 2769-149	12.18	0.23	7.849294	2453279.850000	DCEP
234416+321042	GSC 2771-790	12.21	0.20	0.057163	2453255.484126	DSCT
235119+333351	GSC 2772-761	14.01	0.36	0.219197	2453258.780402	RRAB
235508+332228	GSC 2772-1010	12.01	0.12	0.318456	2453255.882075	RRC

Table 2. List of new variables for which spectral type was determined. *SAVS ID* – identifier, *Other ID* – cross-identification with other catalogs, $S_{pSIMBAD}$ – spectral type recorded in SIMBAD database, S_{pNEW} – spectral type determined from our observations.

SAVS ID	Other ID	$S_{pSIMBAD}$	S_{pNEW}
SAVS 233827+363450	GSC 2778-1326	–	F3 V
SAVS 234823+361839	GSC 2779-288	F2	F5 V
SAVS 233103+355546	GSC 2777-1366	–	G8 V
SAVS 235439+364516	GSC 2780-2053	–	G0 V
SAVS 234959+312055	SAO 73540	M0	M1 III
SAVS 235131+363603	SAO 73559	M0	M3 III
SAVS 234514+305230	SAO 73479	K7	M3 III
SAVS 235106+360735	GSC 2780-2269	M5	M5 III
SAVS 233754+365304	GSC 2778-1488	–	M5 III

Table 3. List of new semiregular and irregular variables. *SAVS ID* – identifier consisted of Right Ascension and Declination of a star calculated for J2000.0, *Other ID* – cross-identification with other catalogs, m_V – observed maximal brightness in near-Johnson V band, Δm_V – amplitude of variation, P – period of variation in days, T_0 – time of primary minimum for eclipsing binary systems or time of maximum for periodic pulsating variables (in Heliocentric Julian Days), *Type* – type of variability.

SAVS ID	Other ID	m_V	Δm_V	P [days]	T_0 [HJD]	Type
232802+292558	GSC 2256-915	10.24	0.07	–	–	MISC
232804+335631	GSC 2773-1034	12.57	0.52	–	–	MISC
232913+361523	GSC 2777-1022	12.23	0.16	–	–	MISC
232929+295305	GSC 2256-1368	11.22	0.32	–	–	MISC
232930+353002	GSC 2773-330	11.87	0.24	–	–	MISC
232942+310743	GSC 2765-1629	11.10	0.26	–	–	MISC
233158+325051	GSC 2769-785	12.13	0.20	–	–	MISC
233206+323557	GSC 2769-719	10.51	0.22	–	–	MISC
233352+300736	SAO 91347	9.12	0.11	–	–	MISC
233403+295211	NSV 14620	10.01	0.68	–	–	MISC
233531+302158	GSC 2766-1156	11.43	0.17	–	–	MISC
233649+334136	GSC 2770-66	12.47	0.48	–	–	MISC
233754+365304	GSC 2778-1488	10.75	0.20	–	–	MISC
233828+312111	GSC 2766-1793	13.07	0.27	–	–	MISC
233854+351217	GSC 2774-960	11.54	0.53	114.504	2453451.258422	SR
234029+295912	GSC 2257-1396	11.12	0.20	–	–	MISC
234056+360927	SAO 73432	9.46	0.09	–	–	MISC
234258+344544	SAO 73457	9.97	0.26	–	–	MISC
234514+305230	SAO 73479	9.32	0.11	–	–	MISC
234617+302446	GSC 2767-1716	12.94	1.64	–	–	MISC
234632+335103	GSC 2775-63	10.22	0.13	–	–	MISC
234651+353917	GSC 2779-1587	10.76	0.14	–	–	MISC
234755+290107	GSC 2257-2585	13.34	0.28	–	–	MISC
234859+311759	GSC 2767-877	9.77	0.13	–	–	MISC
234859+315849	GSC 2771-771	11.88	0.18	–	–	MISC
234958+344158	GSC 2775-792	13.84	0.50	–	–	MISC
234959+312055	SAO 73540	9.59	0.19	–	–	MISC
235034+321429	GSC 2771-142	9.49	0.17	–	–	MISC
235106+360735	GSC 2780-2269	9.19	0.37	–	–	MISC
235111+342447	GSC 2776-1630	12.05	0.56	65.445	2453379.762068	SR
235131+363603	SAO 73559	9.20	0.08	–	–	MISC
235132+351854	GSC 2776-1687	12.45	0.29	58.005	2453360.889533	SR
235246+335518	GSC 2776-384	13.15	0.38	–	–	MISC
235301+335135	–	11.74	0.16	–	–	MISC
235357+331056	GSC 2772-1244	13.72	0.51	–	–	MISC
235417+323533	GSC 2772-638	11.62	0.24	–	–	MISC
235525+360949	GSC 2780-766	10.56	0.08	–	–	MISC
235526+344700	GSC 2776-417	12.70	0.24	–	–	MISC
235608+350531	GSC 2776-572	11.40	0.21	–	–	MISC

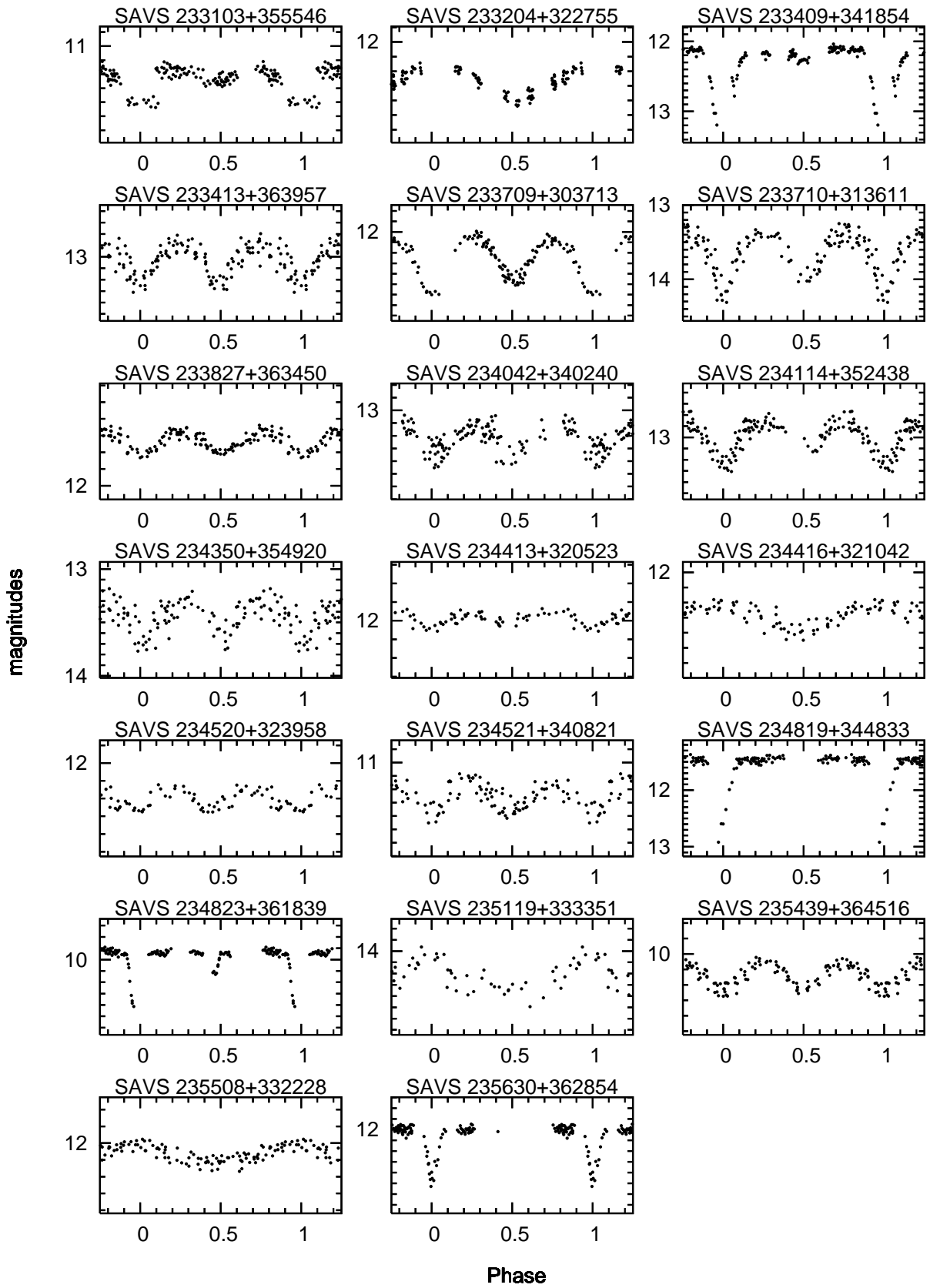


Figure 1. Light curves of new regular variables.

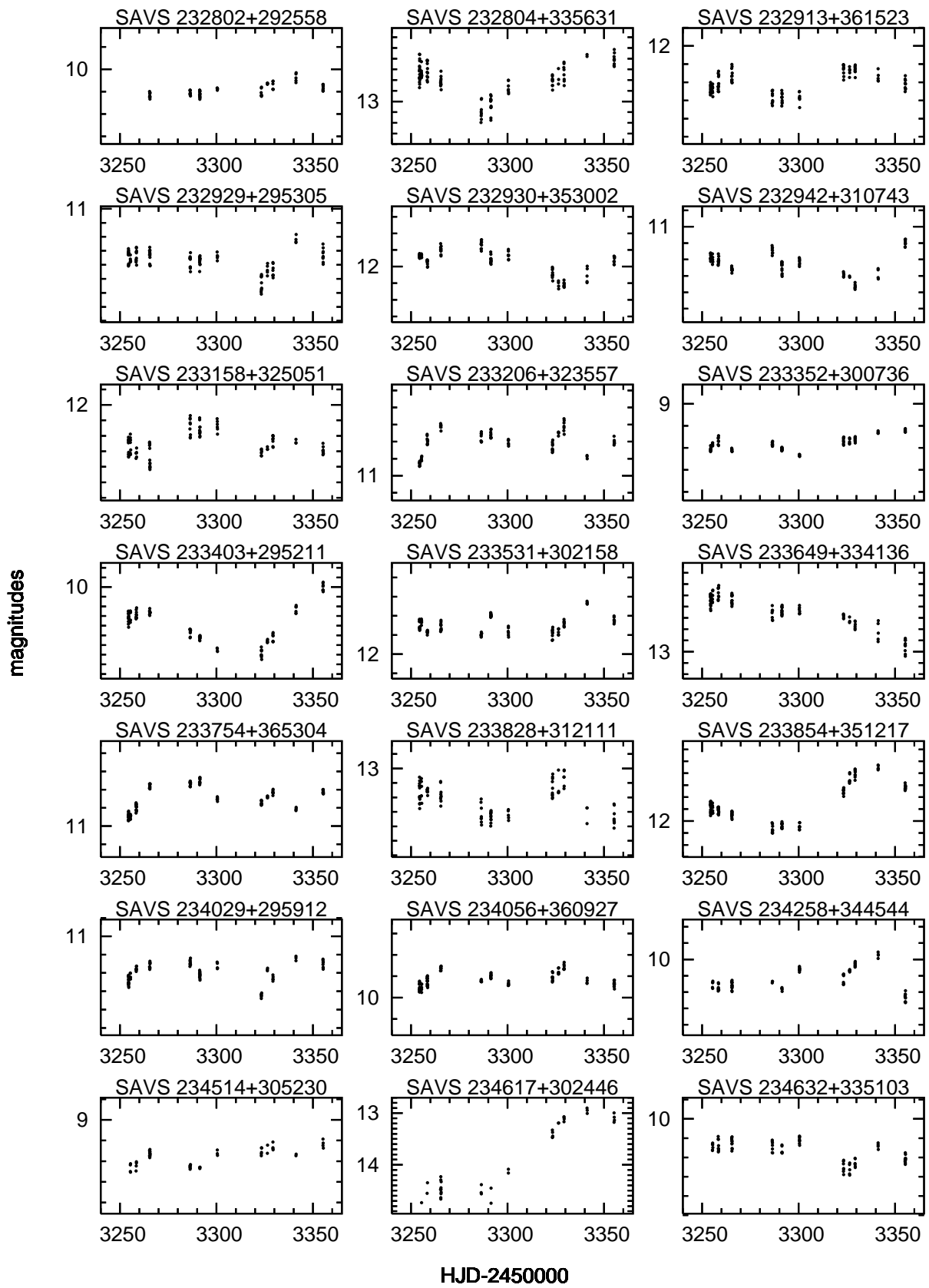


Figure 2. Light curves of new semiregular and irregular variables.

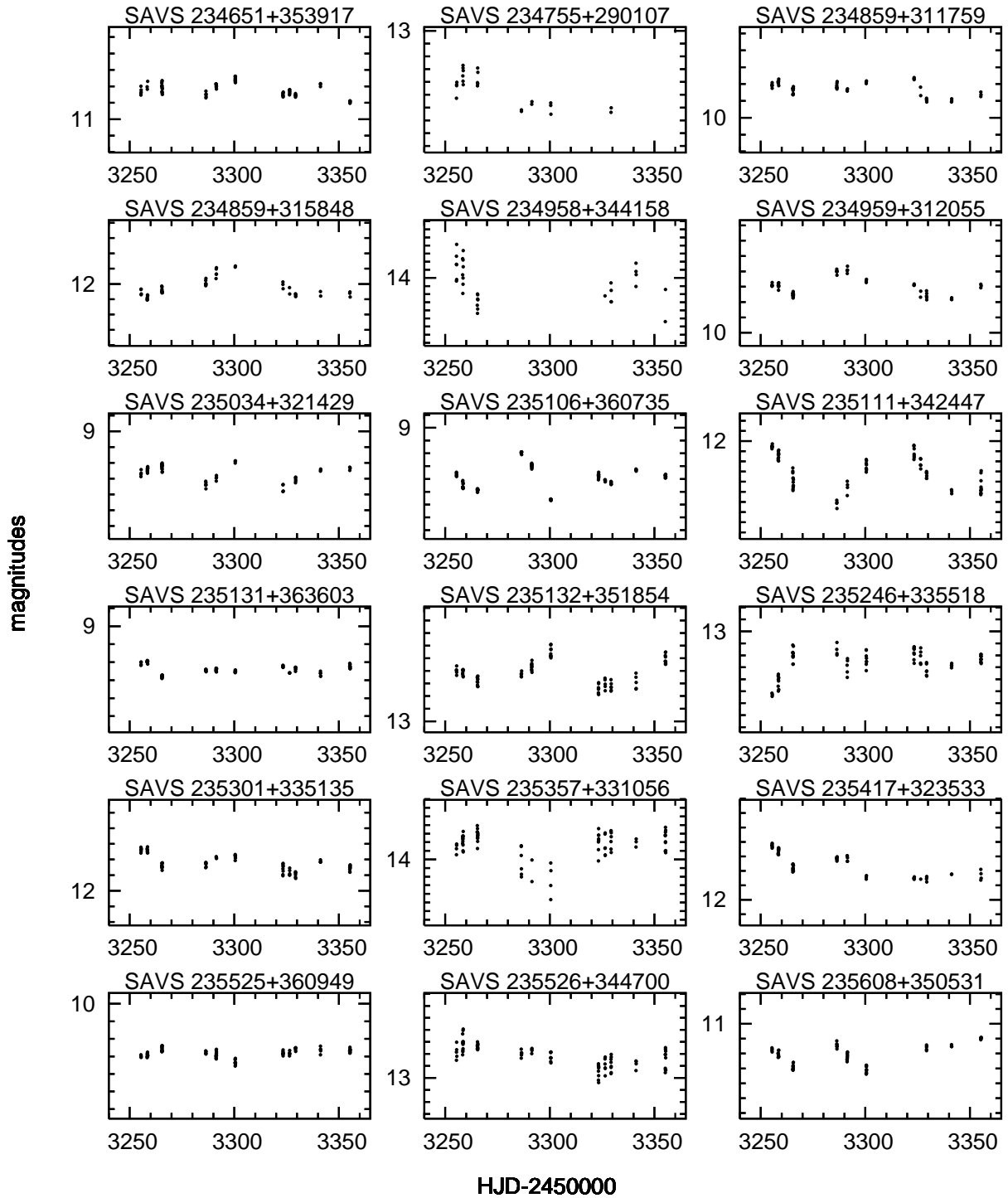


Figure 3. Light curves of new semiregular and irregular variables.

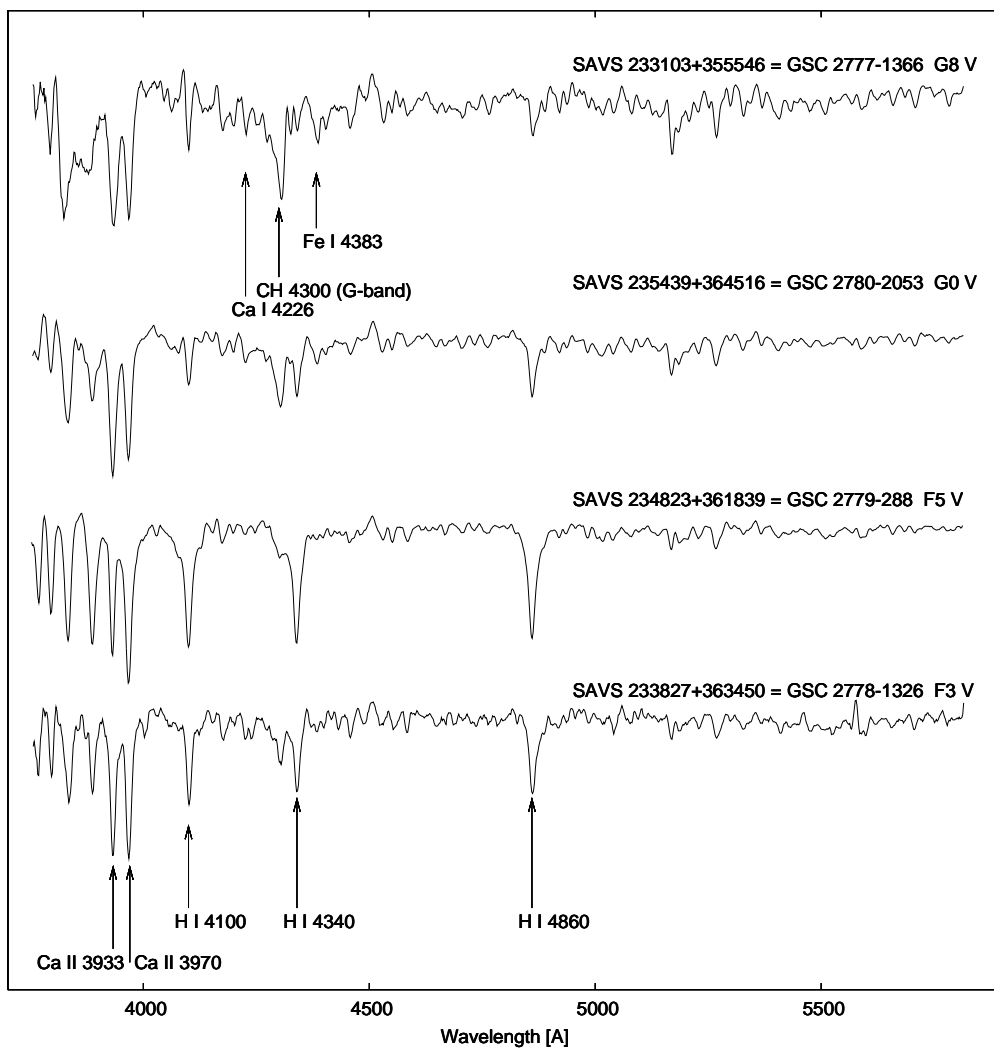


Figure 4. Spectra of several newly detected variables of early spectral type.

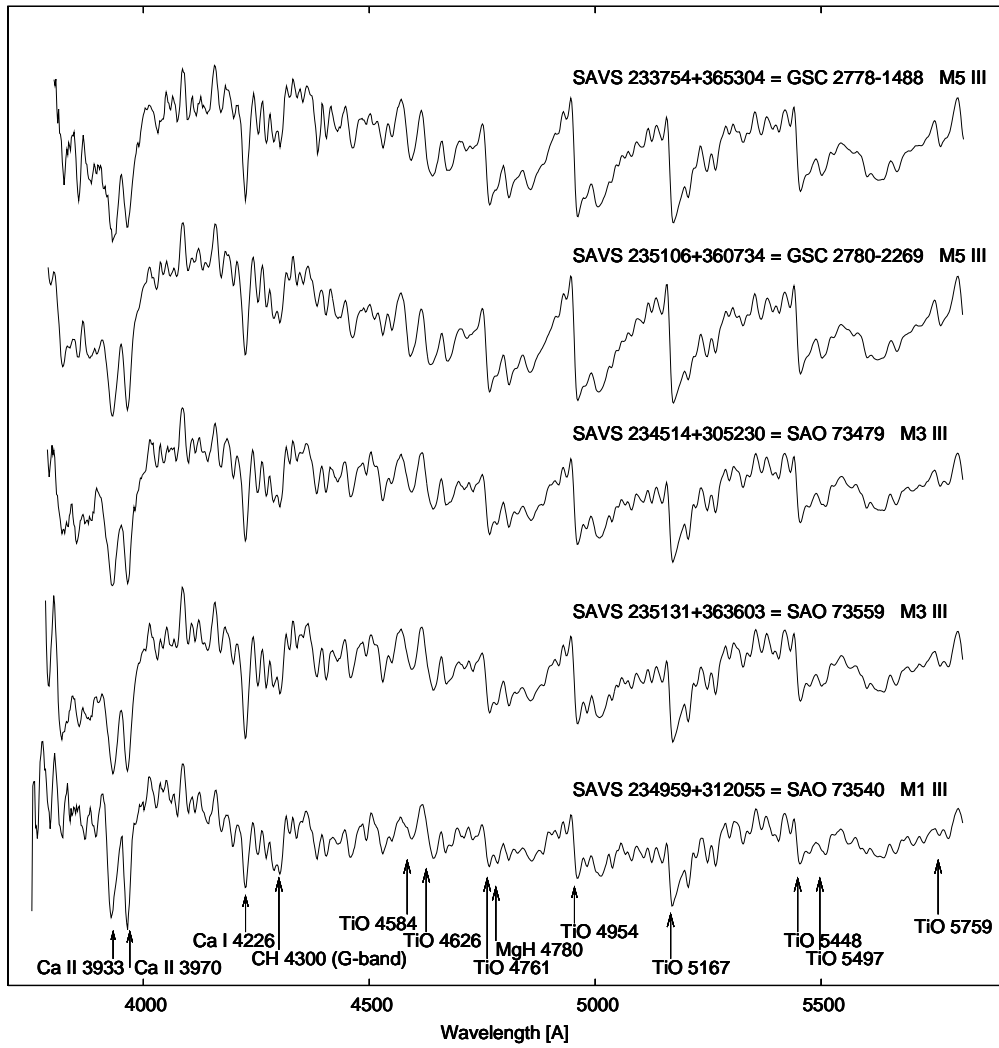


Figure 5. Spectra of several newly detected variables of late spectral type.