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New Suspected Variable (NSV) Stars in the Galactic Open Cluster NGC 2264. Periodic Variables: A CoRoT View

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#	Name	Other	Coord (J2000)	Type	Max	Min	System	Period	Epoch (JD)	type	Sp	Comment	L.Curve	Find.Chart	Data
1	NSV 03077	CoRoT 223973292, CXO J064031.2+093107, 2XMM J064031.2+093107	06 40 31.22, +09 31 07.6	BY:	15.43	(0.13)	CoRoT	1.973	2454548.4	max	K6	Comm. 1	nsv03077.gif		NSV 03077
2	NSV 03114	CoRoT 223980941	06 41 01.52, +10 14 56.5	BY+UV:	15.80	(0.7)	CoRoT	3.846	2454541.4	max		Comm. 2	nsv03114.gif		NSV 03114
3	NSV 03137	CoRoT 500007022, CXO J064113.0+092731, 2XMM J064113.1+092733	06 41 13.03, +09 27 31.8	EA/RS	11.44	(0.06)	CoRoT	5.20	2454546.1	min	F5	Comm. 3	nsv03137.gif		NSV 03137
4	NSV 03144	CoRoT 223985845, 2XMM J064120.6+094534	06 41 20.54, +09 45 35.9	BY	14.88	(0.08)	CoRoT	2.60	2454539.2	max	K5	Comm. 4	nsv03144.gif		NSV 03144
5	NSV 03153	CoRoT 223987553, 2RXP J064127.3+093508, CXO J064127.1+093506, 2XMM J064127.1+093505	06 41 27.13, +09 35 06.5	BY	14.32	(0.20)	CoRoT	1.544	2454542.6	max	K2	Comm. 5	nsv03153.gif		NSV 03153
6	NSV 17076	CoRoT 223981406, CXO J064103.5+093118, 2XMM J064103.5+093119	06 41 03.47, +09 31 18.7	BY	12.81	(0.08)	CoRoT	2.150	2454536.8	max	G2V	Comm. 6	nsv17076.gif		NSV 17076
7	NSV 17124	CoRoT 223986498, CXO J064123.0+092726, 2XMM J064123.0+092727	06 41 23.04, +09 27 27.1	BY:	12.62	(0.07)	CoRoT	3.20	2454537.4	max		Comm. 7	nsv17124.gif		NSV 17124

Comments:

1. Chandra and XMM-Newton sources both with soft hardness ratios. A further period of 0.948 days and amplitude 0.003 magnitudes modulates the main period, as noted by one of the PZP editors (S. Antipin, personal communication).

2. A rotational variable caught during one flare event lasting roughly one third of a day (see lightcurve, flare was removed when creating phaseplot). A possible emission line star, but it is not clear whether it is merged in object prism plates and radio surveys with very nearby (7 to 20 arcsecs) line of sight Herbig Haro Objects associated with HH 124. Although one per lightcurve flare-like gitches are quite frequent in CoRoT flux data their amplitudes are normally barely several times the amplitude of the rest of the data, that is several centimagnitudes at best, whilst this event reached 700 to 800 centimagnitudes. The tabulated elements are for the BY Dra periodicity. The amplitude of BY variations is 0.08 mag.

3. Combined eclipsing and rotating variable, with a pseudosynchronous orbit and rotation with 8:5 resonance (see lightcurves, eclipse data removed for BY solution). Chandra and XMM-Newton sources both with soft hardness ratios. The tabulated elements are for EA variations. The BY Dra variability elements are the following: Max = 2454554.1 + 3.25E. The BY amplitude is 0.03 mag.

4. XMM-Newton source with soft hardness ratios.

5. Chandra and XMM-Newton sources both with soft hardness ratios.

6. Emission line star HBC 538 (Ca II H and K in emission). Chandra and XMM-Newton sources both with soft hardness ratios.

7. Emission line star HBC 541 (Ca II H and K in emission). Chandra and XMM-Newton sources both with soft hardness ratios.

Remarks:

A recent release of CoRoT mission exoplanet fields' data included those for stars likely connected with the Galactic open cluster NGC 2264 that are also included in the New Suspected Variables' Catalogue, NSV (Kukarkin et al. 1982), and its Supplement (Kazarovets et al. 1998). Using the VizieR B/COROT version these data were crossmatched with the VizieR version of the NSV at B/GCVS to two arcseconds. Of the approximately seventy objects from the cluster and its surroundings so matched, the strictly and cleanly periodic objects with sufficient cycles for analysis from the relatively short duration CoRoT SRa01 (Short Run [Galactic] Anticentre 01) dataset, and which were also mostly unambiguous as to variability type, were analysed.

Most known and suspected variables in the region are logged in SIMBAD as being both probable to known members of this young relatively close Galactic open cluster and of being pre-main sequence stars, and especially so for the stars presented here. The cluster's distance modulus of 9.3 also gives the stars (ignoring local extinction) absolute magnitudes ranging from 2.6 to 6.5, suitable for mid F to late K dwarfs. These factors, in tandem with their measured spectral types (including those for G and K dwarfs), mostly soft hardness ratios in Chandra and XMM-Newton data suggestive of chromospheric activity, and their lightcurve morphology, were taken into account in the determination of the variability classes.

The CoRoT exoplanet fields' data as served via the Institut d'Astrophysique Spatiale (IAS) carries information with respect to the stars including three types of automated variability classification and their probabilities as outlined in Debosscher et al. (2009), with the IAS server including the same information for data releases appearing since the publication of that "N3 level" paper. Only objects where the likely variability type was not one of those listed in their data summaries were retained for analysis. That is, only objects inappropriately identified in the CoRoT system were in need of classification, whilst objects presented there that could be seen to having been correctly classified via the CoRoT system were not examined any further.

The CoRoT "N2 data" (Baudin et al. 2008) carries instrumental fluxes with no current means of transferring the data to a standard system, in fact as the exoplanet experiment is not primarily targetted at variable stars, and uses atypical measurement methods in order to distinguish between exoplanet and stellar signals (see e.g. Debosscher et al. 2009), it may never generally be able to be so transferred. The data servers list representative magnitudes for each object's summary information, but these magnitudes are not from measurements made by the experiment itself. Thus the above table for the stars carries the representative V magnitude from the CoRoT exoplanet database in the max column, and the parenthetic value in the min column is the instrumental amplitude in magnitudes (for stars with two types of variability, their combined amplitudes are tabulated; see also the comments). This was tested via the CoRoT data for two well studied known variables, despite there are unfortunately very few well known variables that the CoRoT fields include. The magnitudes for CoRoT monochromatic data (Baudin et al. 2008) were thus checked againts the RR Lyrae variable V1127 Aquilae, and for the chromatic data (ibid) the greenflux was checked against the eclipsing binary DW Monocerotis, in both cases checked using All Sky Automated Survey Johnson V data for the same objects (Pojmanski 2002). The amplitude agreement of the differing sources were found to match well, and the CoRoT derived amplitudes thus seem representative. Further, the phaseplots plot differential instrumental magnitude mostly around a median point as per CoRoT science teams' practice (e.g. Debosscher et al 2009).

In some cases where the amplitude is relatively large, the details of any suspected erratic variability may well show that the original discovery merely sampled a simple periodic variable sparsely. However, as these are young pre-main sequence stars and thus can be prone to erratic behaviour, current fairly stable periodic behaviour as demonstrated by the short CoRoT data run does not necessarily mean that earlier suspected higher to much higher amplitude variability was erroneous. The example of the flaring BY Draconis variable in the above table illustrates this point.

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