The Kepler characterization of the variability among A- and F-type stars. I. General overview

K. Uytterhoeven, A. Moya, A. Grigahcene, J.A. Guzik, J. Gutierrez-Soto, B. Smalley, G. Handler, L.A. Balona, E. Niemczura, L. Fox Machado, S. Benatti, E. Chapellier, A. Tkachenko, R. Szabo, J.C. Suarez, V. Ripepi, J. Pascual, P. Mathias, S. Martin-Ruiz, H. Lehmann, J. Jackiewicz, S. Hekker, M. Gruberbauer, R.A. Garcia, X. Dumusque, D. Diaz-Fraile, P. Bradley, V. Antoci, M. Roth, B. Leroy, S.J. Murphy, P. De Cat, J. Cuypers, H. Kjeldsen, J. Christensen-Dalsgaard, M. Breger, A. Pigulski, L.L. Kiss, M. Still, S.E. Thompson, J. Van Cleve

(Submitted on 1 Jul 2011 (v1), last revised 31 Aug 2011 (this version, v2))

The Kepler spacecraft is providing time series of photometric data with micromagnitude precision for hundreds of A-F type stars. We present a first general characterization of the pulsational behaviour of A-F type stars as observed in the Kepler light curves of a sample of 750 candidate A-F type stars. We propose three main groups to describe the observed variety in pulsating A-F type stars: gamma Dor, delta Sct, and hybrid stars. We assign 63% of our sample to one of the three groups, and identify the remaining part as rotationally modulated/active stars, binaries, stars of different spectral type, or stars that show no clear periodic variability. 23% of the stars (171 stars) are hybrid stars, which is a much larger fraction than what has been observed before. We characterize for the first time a large number of A-F type stars (475 stars) in terms of number of detected frequencies, frequency range, and typical pulsation amplitudes. The majority of hybrid stars show frequencies with all kinds of periodicities within the gamma Dor and delta Sct range, also between 5 and 10 c/d, which is a challenge for the current models. We find indications for the existence of delta Sct and gamma Dor stars beyond the edges of the current observational instability strips. The hybrid stars occupy the entire region within the delta Sct and gamma Dor instability strips, and beyond. Non-variable stars seem to exist within the instability strips. The location of gamma Dor and delta Sct classes in the (Teff,logg)-diagram has been extended. We investigate two newly constructed variables 'efficiency' and 'energy' as a means to explore the relation between gamma Dor and delta Sct stars. Our results suggest a revision of the current observational instability strips, and imply an investigation of other pulsation mechanisms to supplement the kappa mechanism and convective blocking effect to drive hybrid pulsations.

Comments:	Accepted for publication in Astronomy and Astrophysics (language edited version). 70 pages, 4 tables, 13 figures. The tables can be found as an appendix to the paper. The quality of the figures has been downgraded compared to the original
Subjects:	**Solar and Stellar Astrophysics (astro-ph.SR)**
DOI:	10.1051/0004-6361/201117368
Cite as:	**arXiv:1107.0335 [astro-ph.SR]**
	(or **arXiv:1107.0335v2 [astro-ph.SR]** for this version)

Submission history

From: Katrien Uytterhoeven [view email]

[v1] Fri, 1 Jul 2011 20:54:15 GMT (652kb)
[v2] Wed, 31 Aug 2011 17:10:41 GMT (655kb)

Which authors of this paper are endorsers?