

Short period variables in the Kepler field



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Inspiration: The Rapid Temporal Survey (RATS) was a high cadence, deep photometric survey conducted between 2003-2010 which had a sky coverage of ~ 40 square degrees. Our primary aim was to discover AM CVn binaries - double degenerate systems with an orbital period 5-70 minutes - we also successfully identified a variety of other systems which exhibited variability on short timescales. Followup spectroscopy of blue sources which showed short period variability was obtained. See Barclay et al 2001 for a full description.

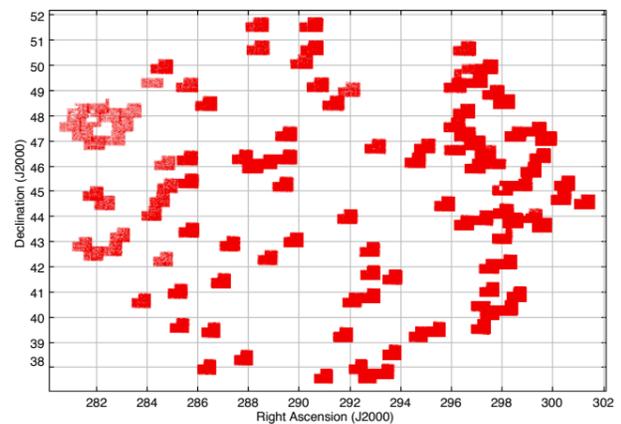
RATS-Kepler: In the summer of 2011 we commenced a deep, high cadence photometric survey of the Kepler field using the Isaac Newton Telescope on La Palma. We take a series of 20 second exposures in the g band lasting one hour, this allowed us to be sensitive to objects in the range $13.5 < g < 21$. This method differed from the original RATS survey in that we point at one region of sky for one hour instead of the original two, which allows us to be sensitive to objects which vary on timescales of 2 minutes to 1 hour, whilst considerably increasing the amount of sky that can be covered in an observation run. Unlike other surveys we aim to cover the entire Kepler field. Currently we have covered $\sim 30\%$ of the Kepler field, with further observations scheduled for May 2012 at Kitt Peak Observatory and followup spectroscopic observations on the INT in June 2012.

Our ultimate goal is to obtain photometry of our most astrophysically interesting sources using Kepler in short cadence mode. We currently have two objects being observed in short cadence mode, with a further 21 awaiting approval.

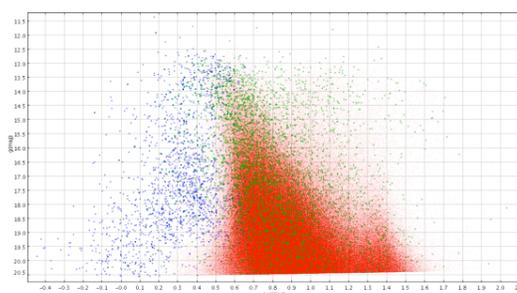
EGAPS-Kepler: The EGAPS-Kepler team commenced a survey in summer 2011 seeking to obtain colour information for objects in the Kepler field. Our collaboration has allowed us to obtain extra information to aid in the classification of objects. Notable examples are a suspected candidate CV system and a pulsating DA white dwarf - only the 2nd confirmed pulsating white dwarf in the Kepler field which is currently being observed by Kepler in short cadence mode. Details can be found in Greiss et al 2012, which includes a public link to their dataset.



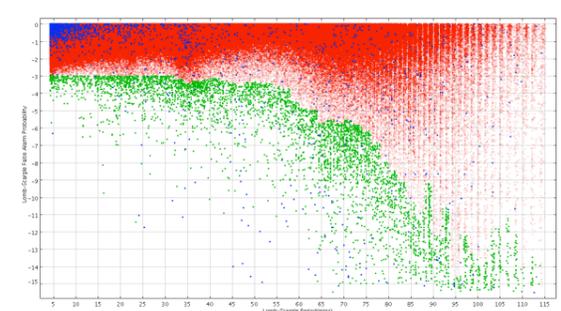
The Isaac Newton Telescope



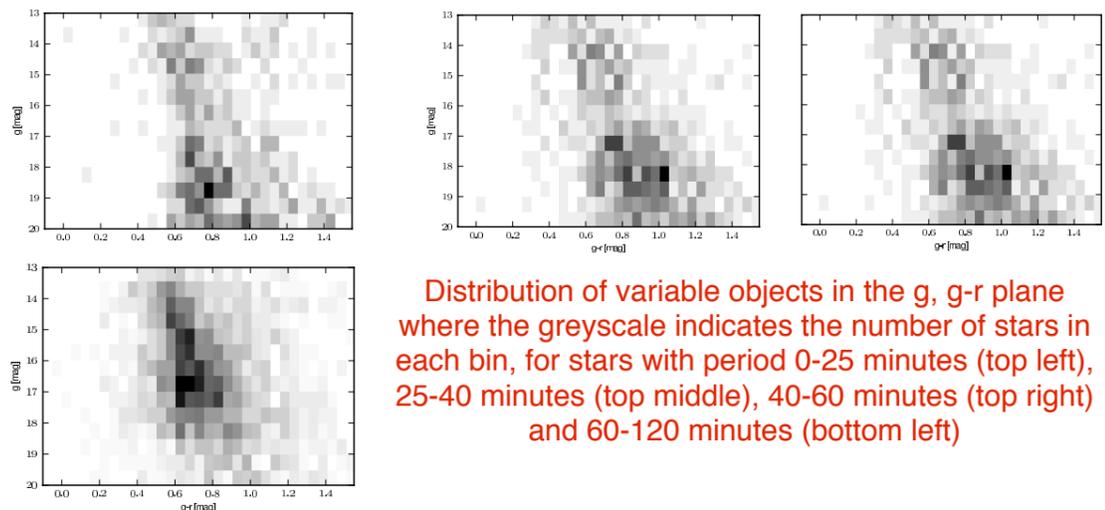
The locations of our fields observed in July/August 2011



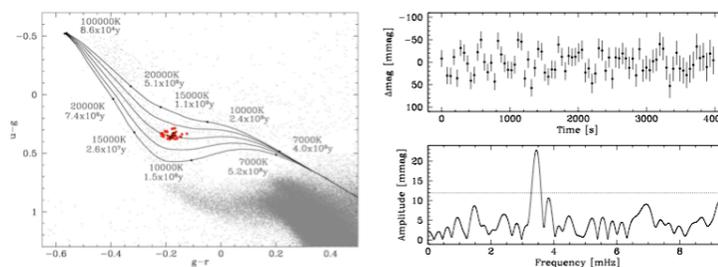
Colour-Magnitude diagram of all our stars (red), blue objects (blue) and those selected as significantly variable via statistical analysis (green)



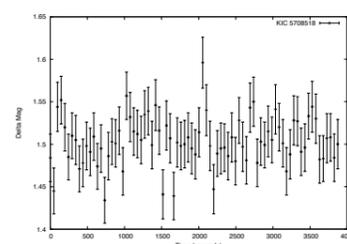
All stars (red) in a variability-significance of variability plot where increasing negative values indicate a higher degree of variability, with blue sources (blue) and those selected as significantly variable (green)



Distribution of variable objects in the g, g-r plane where the greyscale indicates the number of stars in each bin, for stars with period 0-25 minutes (top left), 25-40 minutes (top middle), 40-60 minutes (top right) and 60-120 minutes (bottom left)



KIC 11911480 - Based on colour data obtained by the EGAPS team a set of candidate white dwarfs was selected (left image). Our light curve data showed that KIC 11911480 is variable with a period of 290 sec making it very probably a pulsating white dwarf. It is currently being observed by Kepler in Short Cadence Mode.



KIC 5708518 - This was a known PG1159 star prior to our observations. Our 1 hr observation provided evidence that it was variable on a period of 240 sec: this makes it the first known pulsating PG1159 in the Kepler field. We are currently obtaining Kepler Short Cadence Mode observations of this source. These data will allow us to probe the internal structure of this very hot, pre-white dwarf.

Data-release: The data has been reduced with a paper discussing the most interesting results imminent (Brooks et al). We intend to make the photometric parameters (the measure of variability according to various criteria) publicly available for all sources in the near future.

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