K2 Fields 2 and 3 Proposal:

A dedicated survey of M dwarfs

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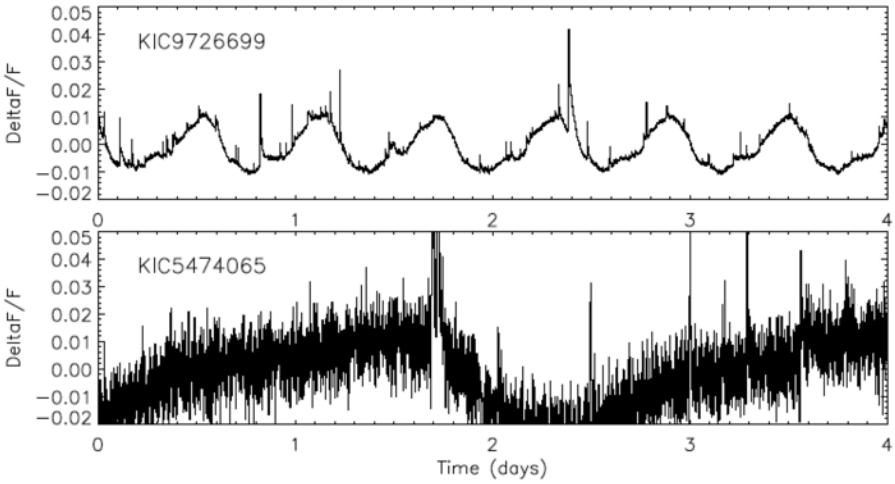
Kepler has already provided a great resource for the study of stellar flares. For instance Balona et al (2012) reported observations of flares seen in stars with A/F spectral types while Maehara et al (2012) presented some examples of `super' flares on Solar type stars and Walkowicz et al (2011) studied flares from cooler dwarfs. Most of these Kepler observations were made in Long Cadence Mode.

In the RATS-Kepler survey (Ramsay et al 2013) we identified a number of dwarfs which showed short duration flares in data taken using the INT on La Palma. Kepler observations of one of these stars (KIC 5474065 which has an M4V spectral type) were made in Short Cadence mode showed several dozen flares (Ramsay et al 2013) some of which had durations as short as 10 mins (and hence would be missed if it had been observed in Long Cadence Mode). Observations of another M4V dwarf KIC 9726699 showed an extra-ordinary amount of low amplitude short duration flare activity (Ramsay et al 2013 and see the Figure below). With the original Kepler field data one can start to search for stellar cycles through variations in the flare rate over many months.

However, perhaps the most important implications from work such as this is determining the effect that large numbers of relatively low luminosity flares would have on the atmosphere of any exo-planet which was in the habitable zone around the host star. Work by Segura et al (2010) indicated that large flares such as that seen on AD Leo would not be a direct threat to life on an exoplanet in the habitable zone. However, the effect of many regularly occurring relatively low luminosity flares still needs to be investigated.



We have therefore commenced a programme for K2 to observe a sample of M and L type dwarfs (our first paper on AF Psc made using engineering data has been accepted by MNRAS). For Field0 we obtained time to observe a M1.0V, M1.5V in SC mode and a L9V star in LC mode. We have searched the Simbad data base for M dwarfs and used a search radius of 8.5 degrees from the quoted boresight pointing of the K2 Fields 2 and 3. We additionally used the K2 FOV task and find that all our targets are `on active' silicon. Many of our targets have significant proper motions which are included in the EPIC.

We bid for Short Cadence mode for one source in Field 2 and three sources in Field 3. In Field 2 the source (EPIC 205467732) is a known M4.5 flare star as is EPIC 206262336 (Field 3) so will be another direct comparison with the two M4 stars presented in Ramsay et al (2013). EZ Aqr is an M5 dwarf in a 2 yr binary, whilst IL Aqr GJ 876 is a multi-planet system, with periods 1.9 (i~50) , 30 (i~48), 61 (i~84) and 125 (i~60) days. Although these planets were detected through radial velocity studies it will be interesting to search for other planets with different inclinations which maybe transiting and evidence for a transit of the planet with i~84 deg. Most of our Long Cadence mode targets are single MV stars but there are some sources which make them interesting in the wider sense. For instance there are two young T Tau stars which are known to flare - we know of no T Tau star observed in the Kepler field. There are also two BY Dra stars which are known to contain stars spots and show chromospheric activity. It will be interesting to observe how the signature of the spots change over the several month timescale of K2.