

# Kepler-2 Field1 Proposal:

## Flares from M and L dwarfs

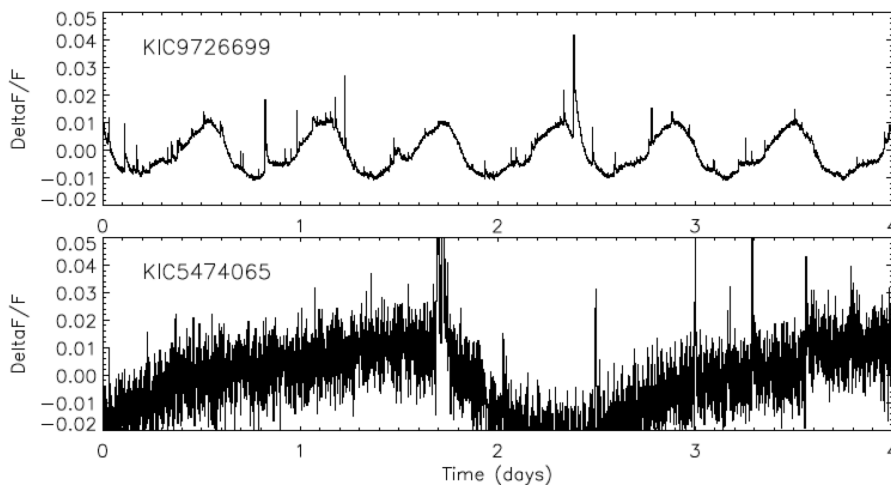
Gavin Ramsay & Gerry Doyle (Armagh Observatory, UK)

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 Kepler 2

to observe a sample of M and L type dwarfs in the various Kepler 2 fields. For Field0 we obtained time to observe a M1.0V, M1.5V in SC mode and a L9V star in LC mode. We have taken three samples of nearby cool or brown dwarf stars (Cruz et al 2007, Thompson et al 2013 and Lepine et al 2013) and used a search radius of 8.5 degrees from the quoted boresight pointing of the Kepler 2 Field 1. We additionally used the Kepler 2 FOV task and find that one is on active silicon and another is flagged as being near the focal plane and worth proposing. Both our targets have significant proper motions. **The Table below gives the co-ordinates in J2000 and in the spreadsheet we give J2000 co-ordinates and also their proper motion in mas/year.** We bid for Short Cadence mode of the M2.5 dwarf star PMI11315+0213 (EPIC 201611969) and Long Cadence observations of the L8.5 star SDSS 115553+055957 (EPIC 201834158) which will be part of our overall Kepler 2 survey of M/L type stars. Although EPIC 201834158 is faint, we would expect to detect flaring activity from this source.

| Source         | RA (2000)  | Dec (2000)  | Spec Type | Kmag | Cadence | FoV Flag |
|----------------|------------|-------------|-----------|------|---------|----------|
| EPIC 201611969 | 11 31 32.8 | +02 13 42.9 | M2.5      | 11.5 | SC      | 2        |
| EPIC 201834158 | 11 55 53.9 | +05 59 57.7 | L8.5      | 17.1 | LC      | 1        |