Kepler-2 Field0 Proposal:

Flares from M and L 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 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) made using Kepler 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). 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 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 12 degrees from the quoted boresight pointing of the Kepler 2 Field 0. (Since many of these sources have high proper motion we have determined their positions for 2014.4). Given the exact field uncertainty and the non negligible chance a source has of not being `on silicon', we have significantly over-bid for sources. We therefore do not expect that even half of our proposed targets would be observed in practice. For our nine M dwarf targets, we bid for Short Cadence mode observations to identify short duration flares (we give their V mag in the attached table). Out of these nine, six were detected in the Rosat All-Sky-Survey indicating the chances of significant flaring activity is high. For the two L dwarfs, they are fainter (we give their I mag in the Table) and hence we opt for Long Cadence Mode. The literature indicates one published paper on Kepler observations of an L dwarf (L1, Gizis et al 2013). Our L dwarf targets have later spectral types (L3.5 and L9) making our proposed observations an excellent sample to compare the flare properties of M and L dwarfs.

Source	RA (2000)	Dec (2000)	Spec Type	V or I mag	RASS?	Cadence
LHS 1858	06:37:10.1	+17:33:53.8	M0.0	V=9.6	Yes	SC
1RXSJ071109.2+131246	07:11:09.2	+13:12:44.1	M0.5	V=11.6	Yes	SC
1RXSJ062614.2+234942	06:26:14.5	+23:49:38.5	M1.5	V=11.8	Yes	SC
HIP 35071	07:15:08.9	+15:55:45.0	M0.0	V=11.4	Yes	SC
TYC 1313-1482-1	06:03:34.8	+15:31:31.1	M0.0	V=10.8	Yes	SC
TYC 1330-879-1	06:46:45.6	+15:57:42.1	M1.0	V=11.1	Yes	SC
Gl 232	06:24:41.8	+23:25:51.3	M4.5	V=13.1	No	SC
G 103-41	06:34:33.4	+31:30:05.7	M3.5	V=12.6	No	SC
LHS 1879	06:54:48.3	+33:15:59.9	M3.0	V=10.1	No	SC
WISE 0608+2429	06:07:38.2	+24:29:48.9	L9	i=20.0	No	LC
2MASSIJ0700366+315726	07:00:36.7	+31:57:18.7	L3.5	I=16.4	No	LC