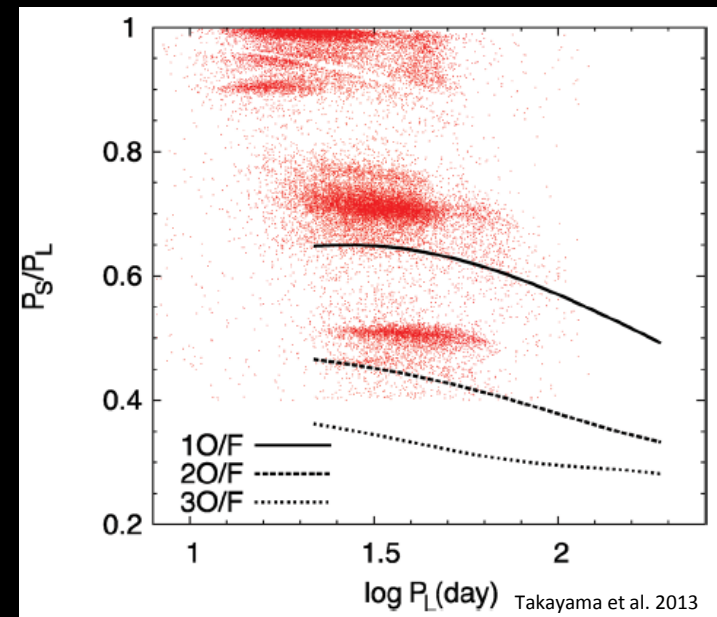
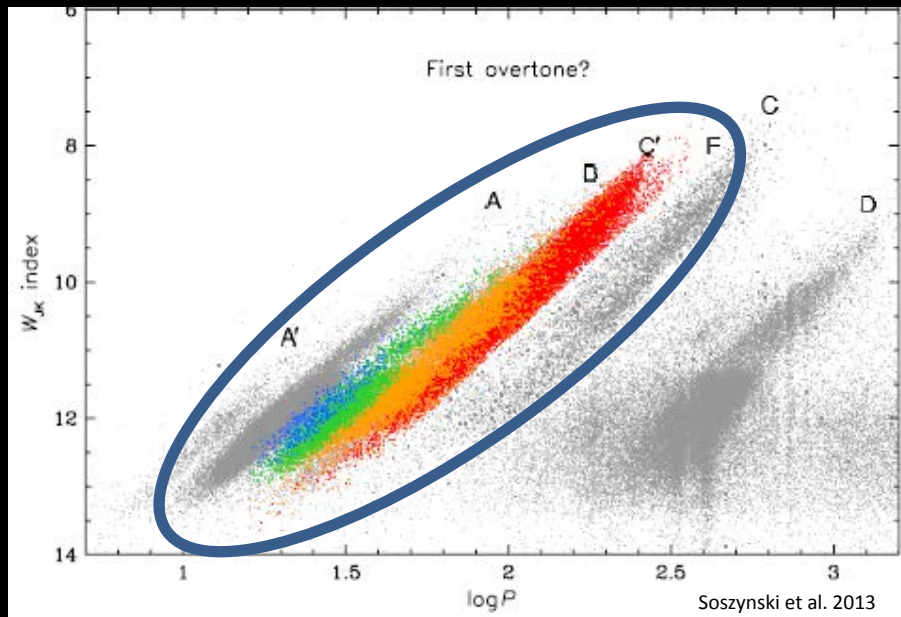


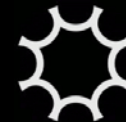
Non-radial modes in M giants



Non-radial modes in M giants

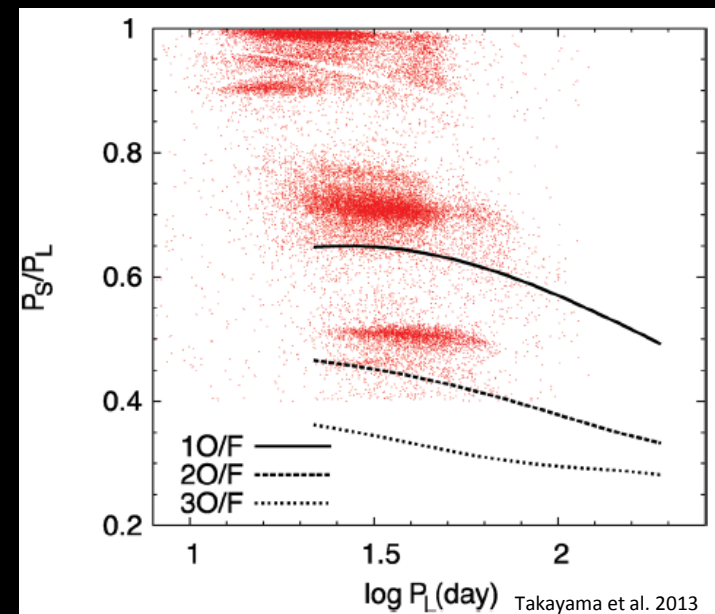
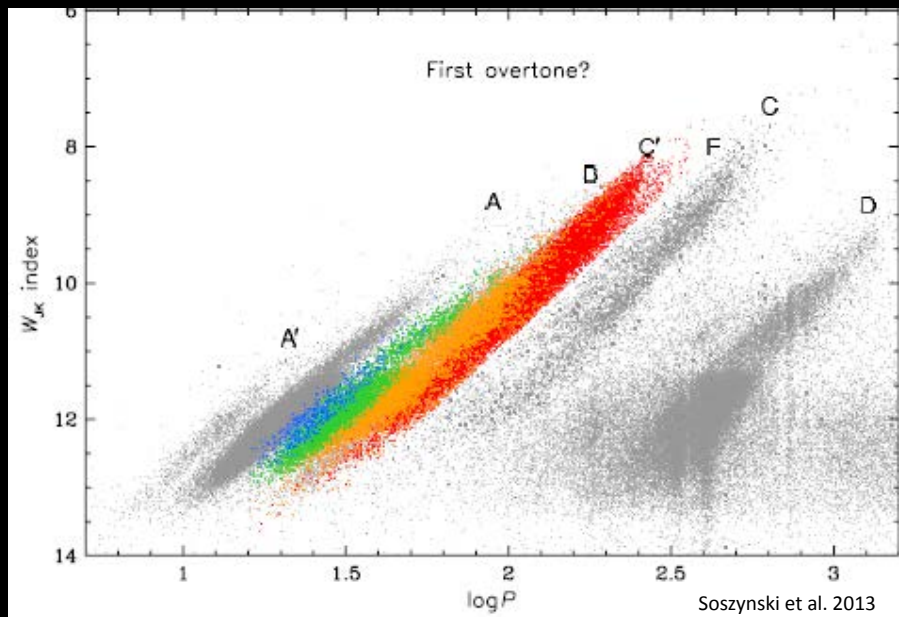


Wood & Sebo (1996)
Bedding & Zijlstra (1998)
Wood et al. (1999)
Wood (2000)
Christensen-Dalsgaard et al. (2001)
Kiss & Bedding (2003)
Groenewegen (2004)
Ita et al. (2004a)
Ita et al. (2004b)
Soszynski et al. (2004)
Bedding et al. (2005)
Fraser et al. (2005)
Lebzelter & Wood (2005)
Olivier & Wood (2005)
Soszynski et al. (2007)
Pigulski et al. (2009)
Dziembowski & Soszynski (2010)
Riebel et al. (2010)
Tabur et al. (2010)
Lebzelter (2011)
Dziembowski (2012)
Soszynski & Wood (2013)
Soszynski et al. (2013)
Takayama et al. (2013)
Xiong & Deng (2013)
Banyai et al. (2013)
Mosser et al. (2013)
Stello et al. (2014)



Non-radial modes in M giants

- No clear evidence of non-radial modes in M-giants.
- No definitive explanation for structure seen in Petersen diagram.

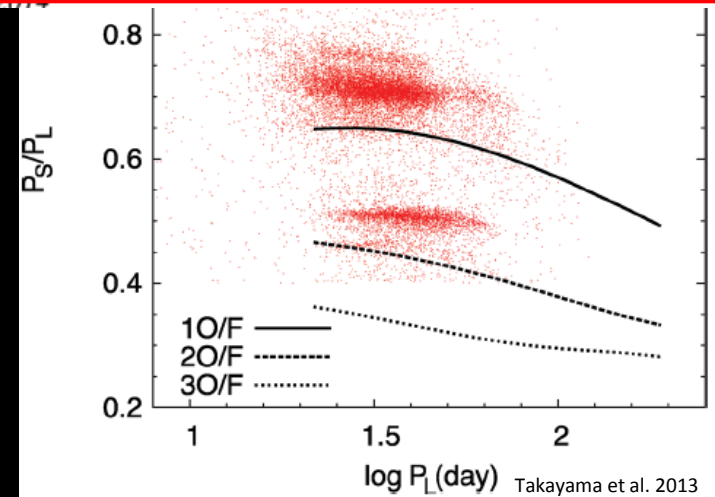
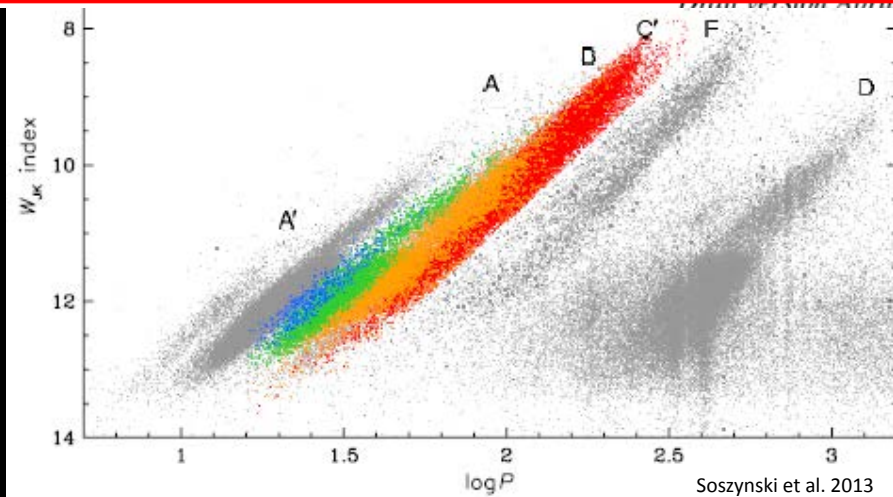


Non-radial modes in M giants

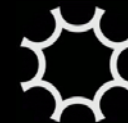
...the coolest of the cool giants

NON-RADIAL OSCILLATIONS IN M-GIANT SEMI-REGULAR VARIABLES: STELLAR MODELS AND *KEPLER* OBSERVATIONS

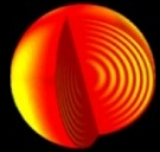
DENNIS STELLO,^{1,2} DOUG COMPTON,¹ TIMOTHY R. BEDDING,^{1,2} JØRGEN CHRISTENSEN-DALSGAARD,² LASZLO L. KISS,^{3,1,4} BEAU BELLAMY,¹ RAFAEL A. GARCÍA,⁵ SAVITA MATHUR,⁶



Dennis Stello



STELLAR ASTROPHYSICS CENTRE



Sun

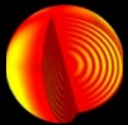
...really big

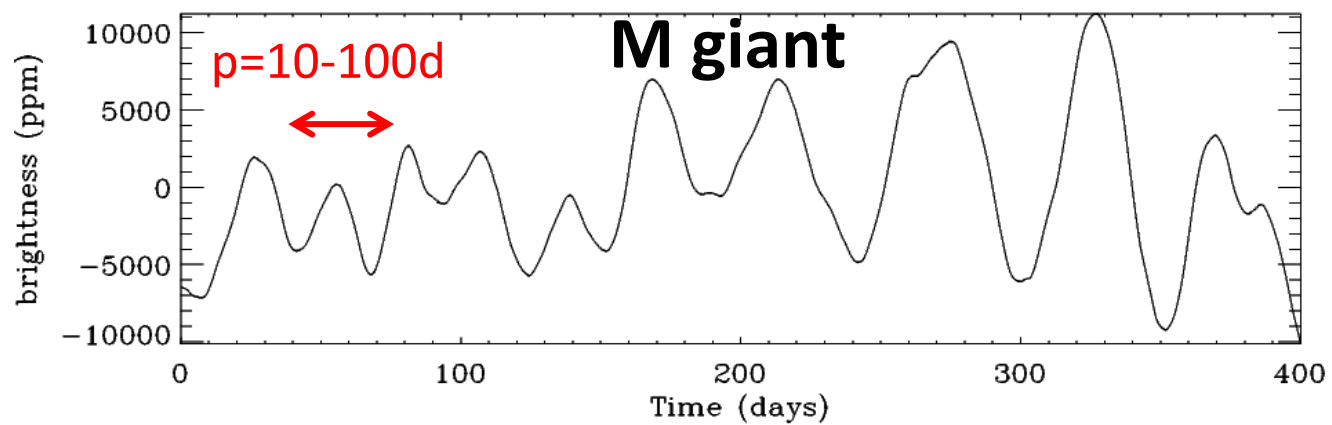
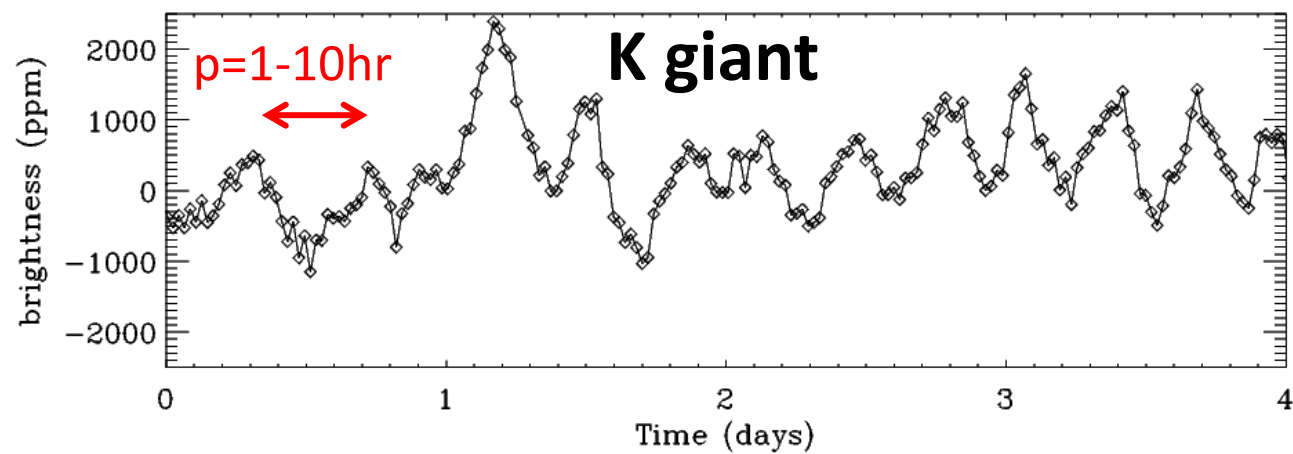
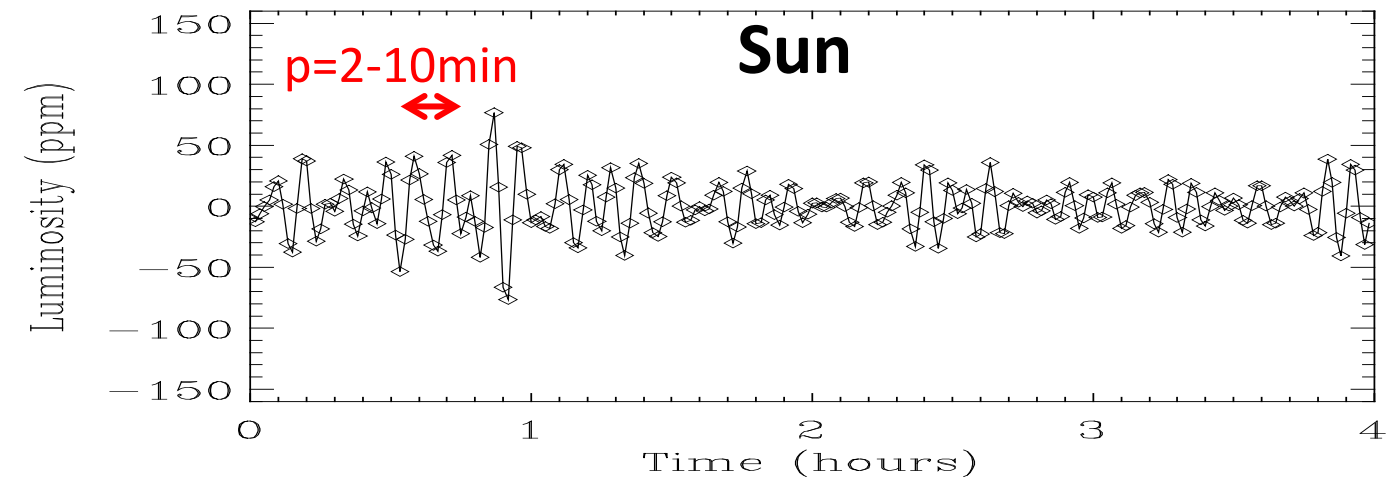
K giant

...really big

Sun K giant

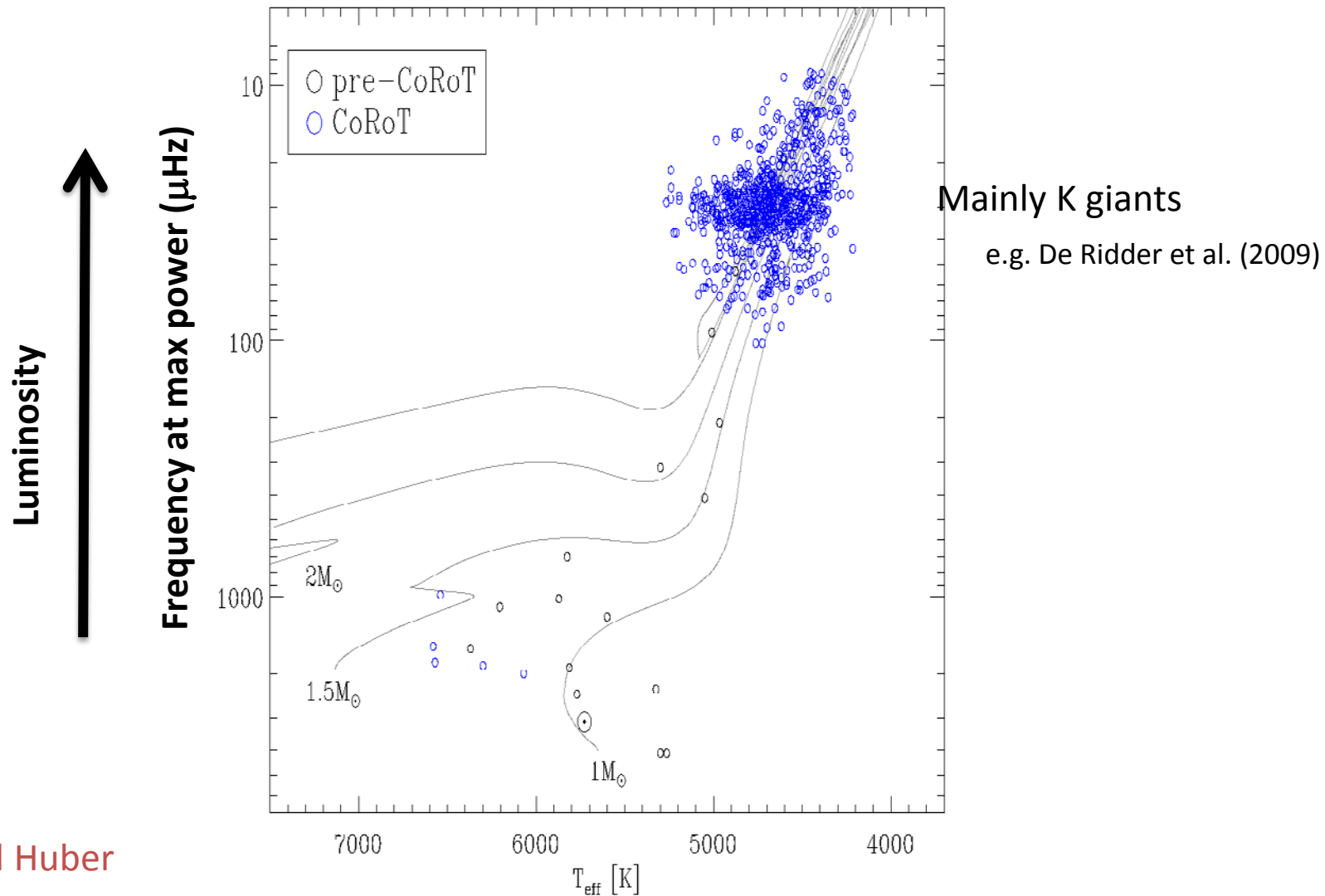
M giant



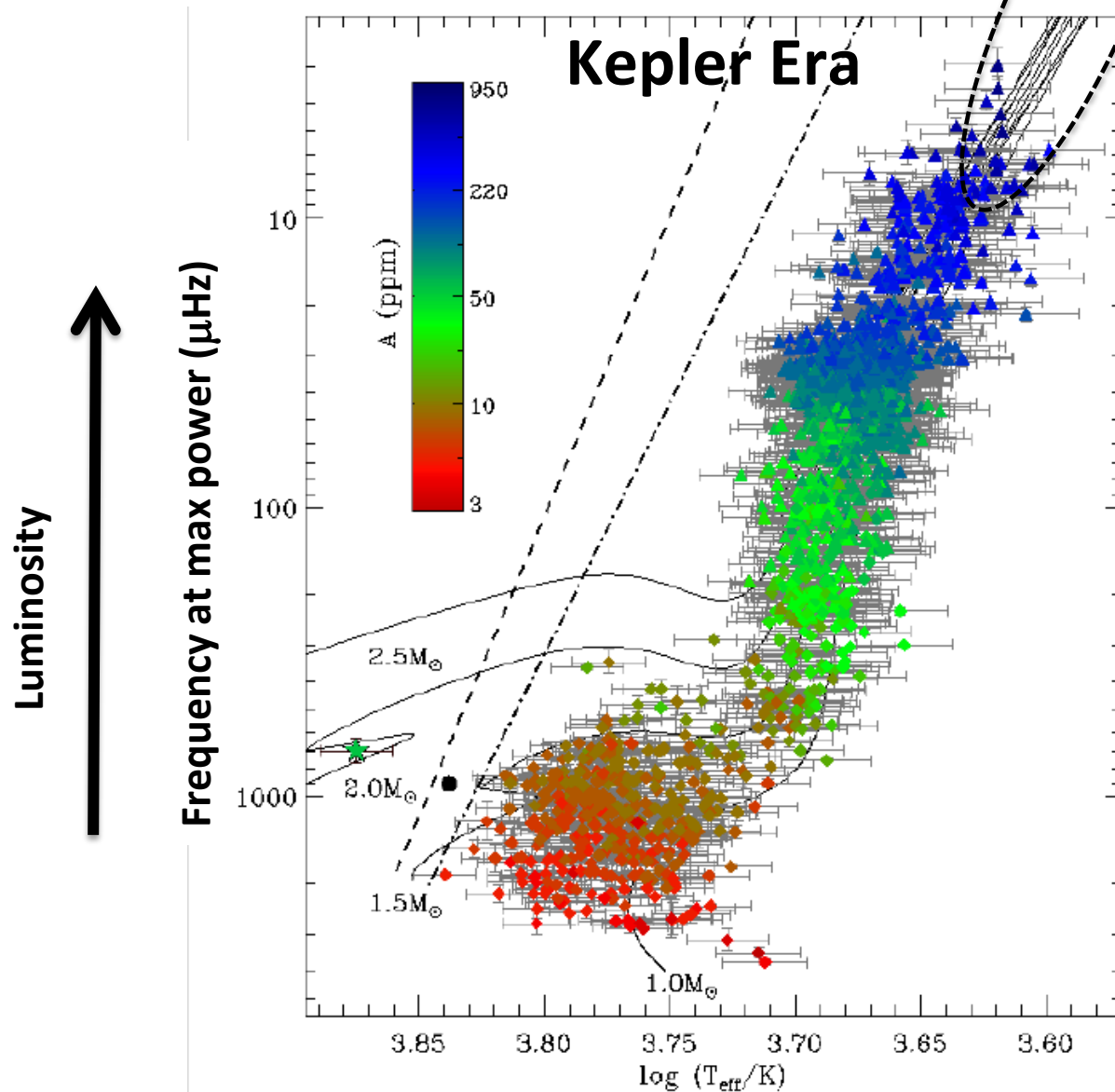


The asteroseismic revolution

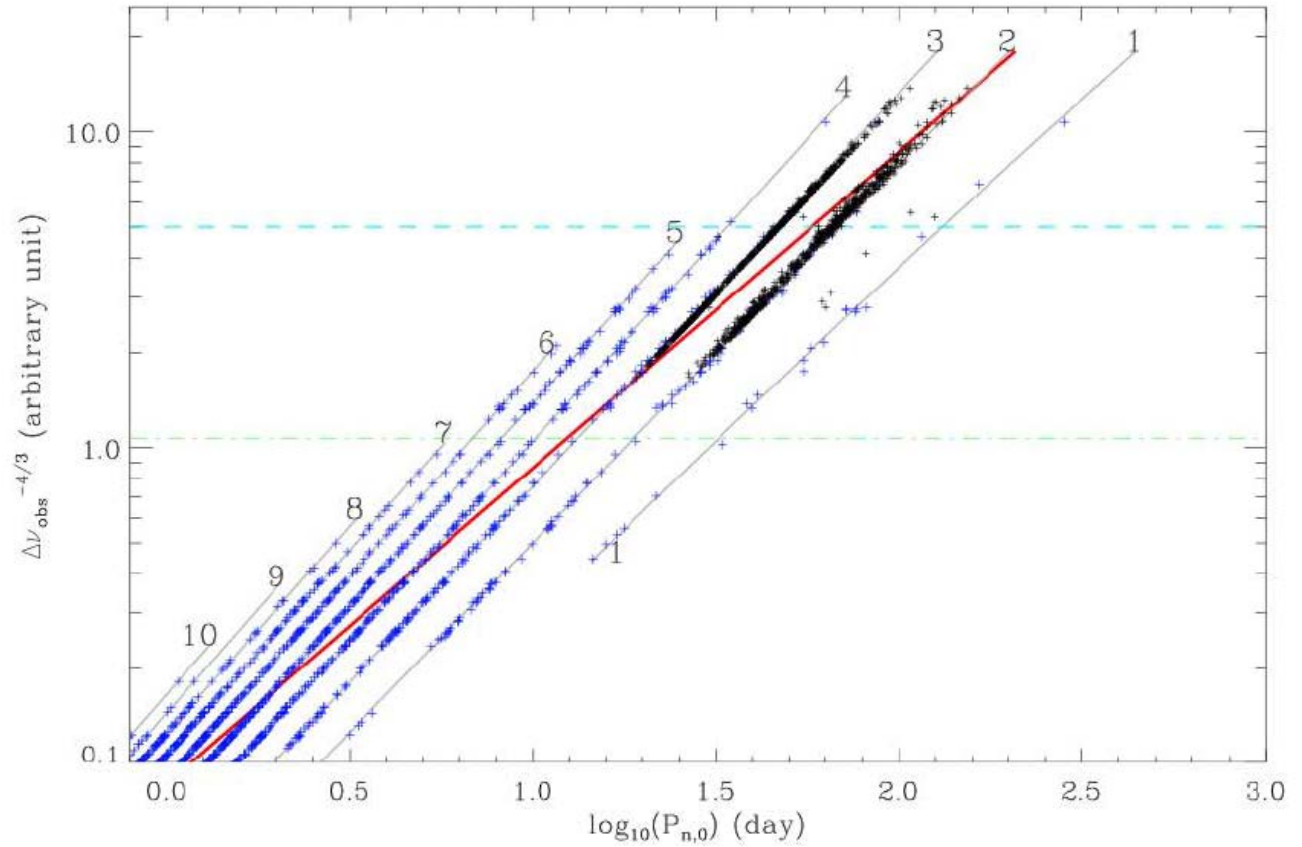
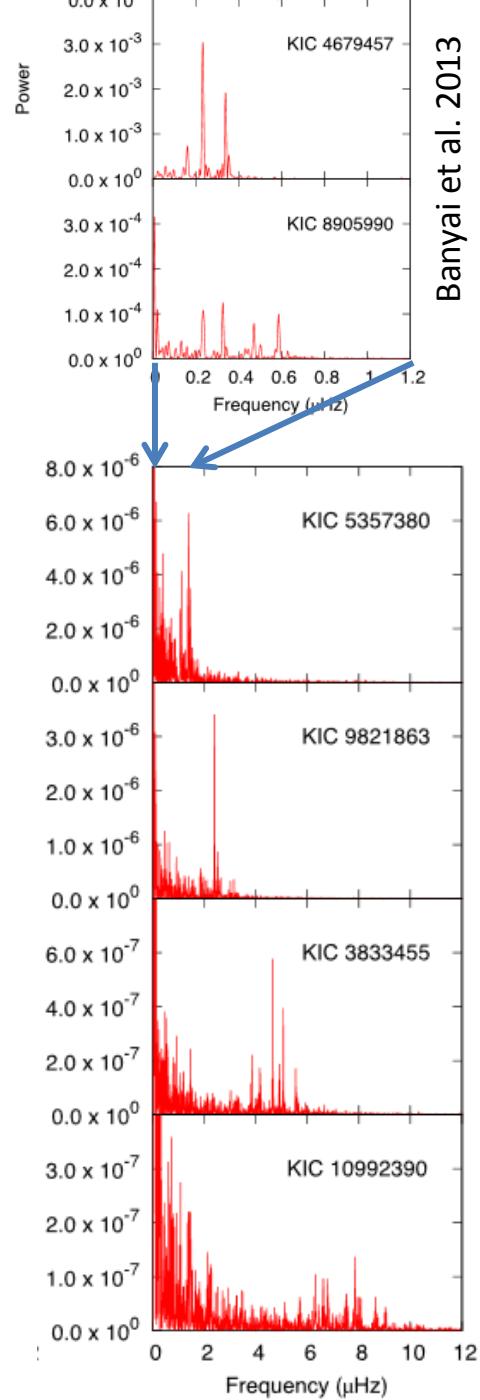
Post-CoRoT (2009)



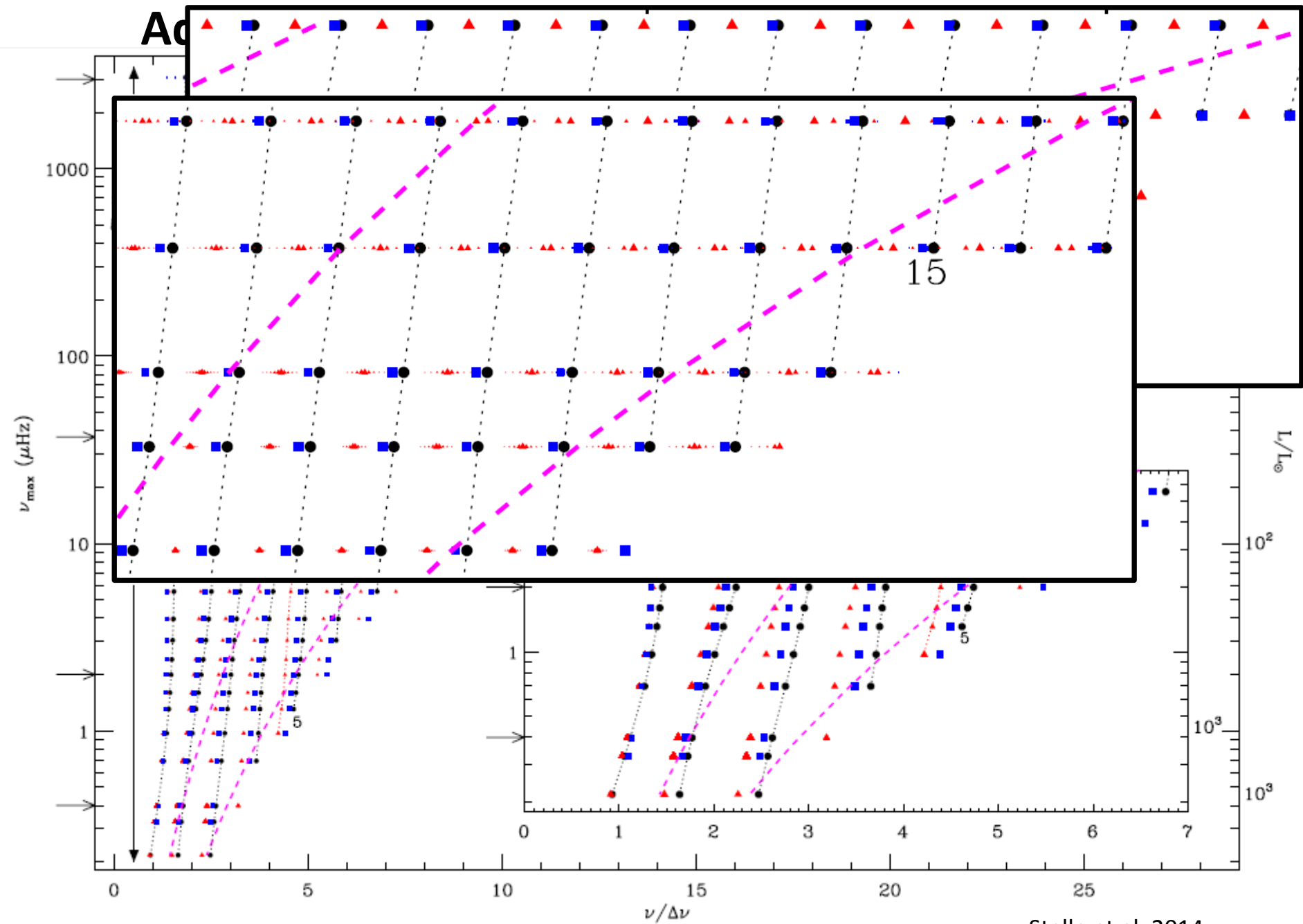
The asteroseismic revolution



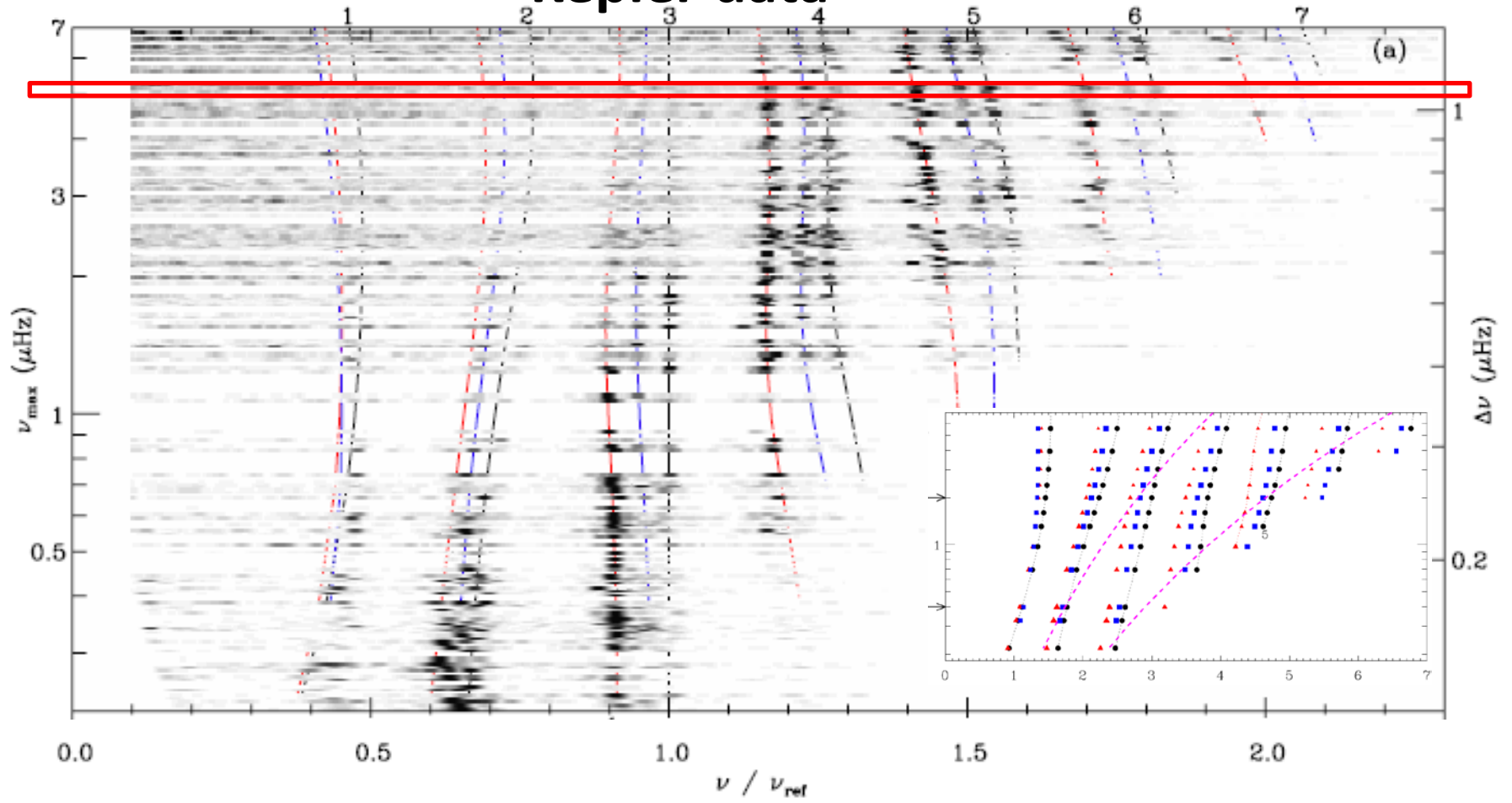
First M-giant Kepler results



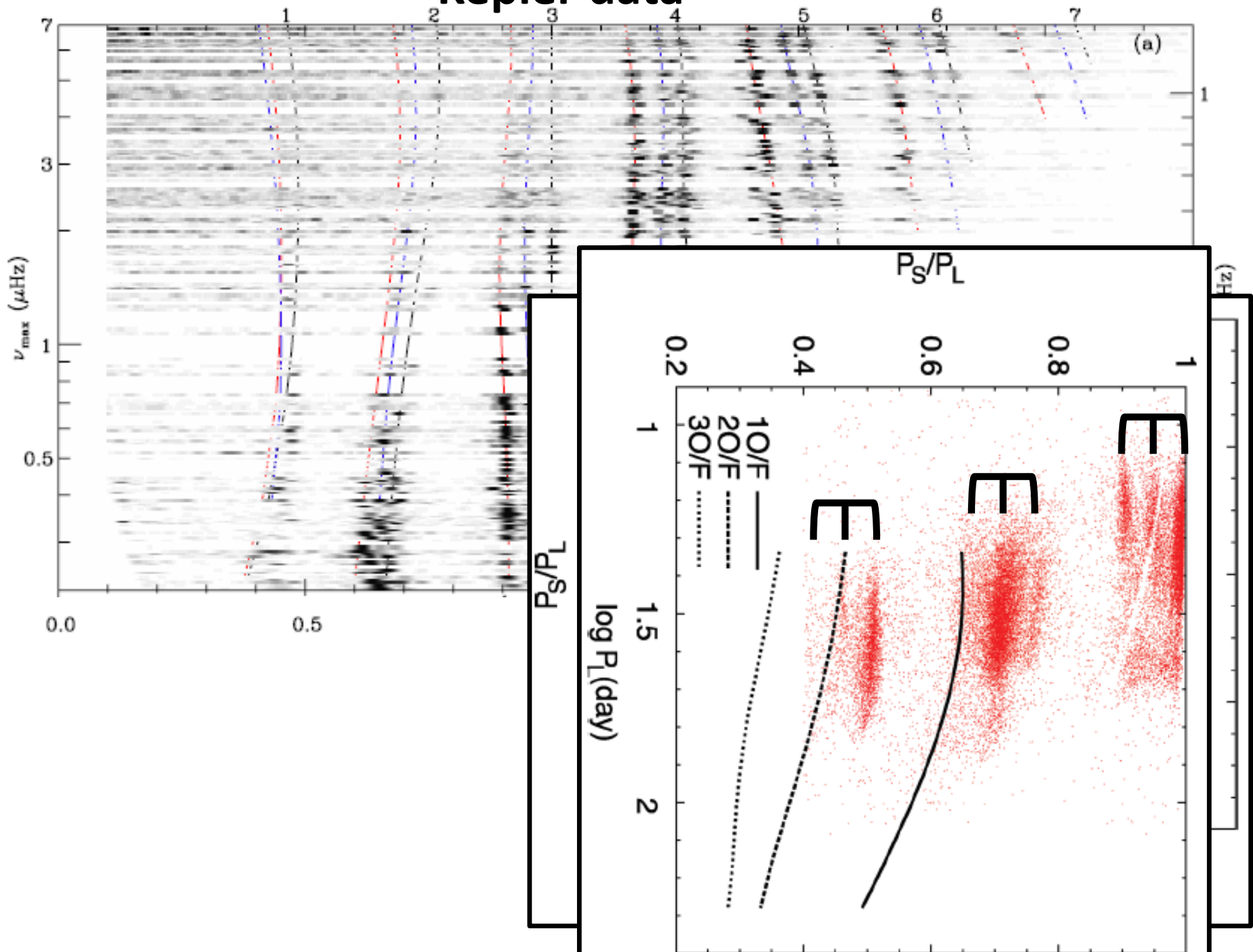
Mosser et al. 2013



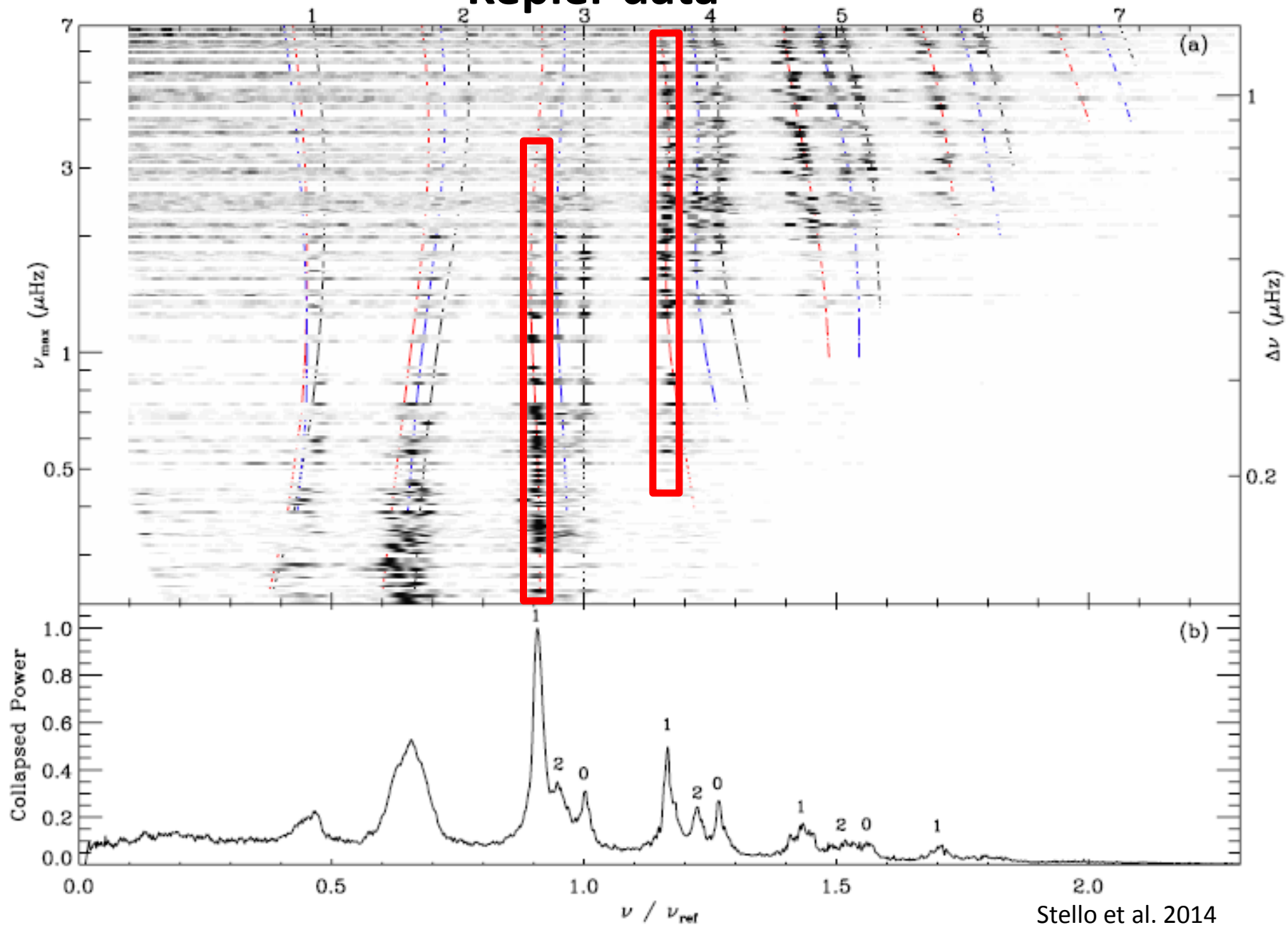
Kepler data



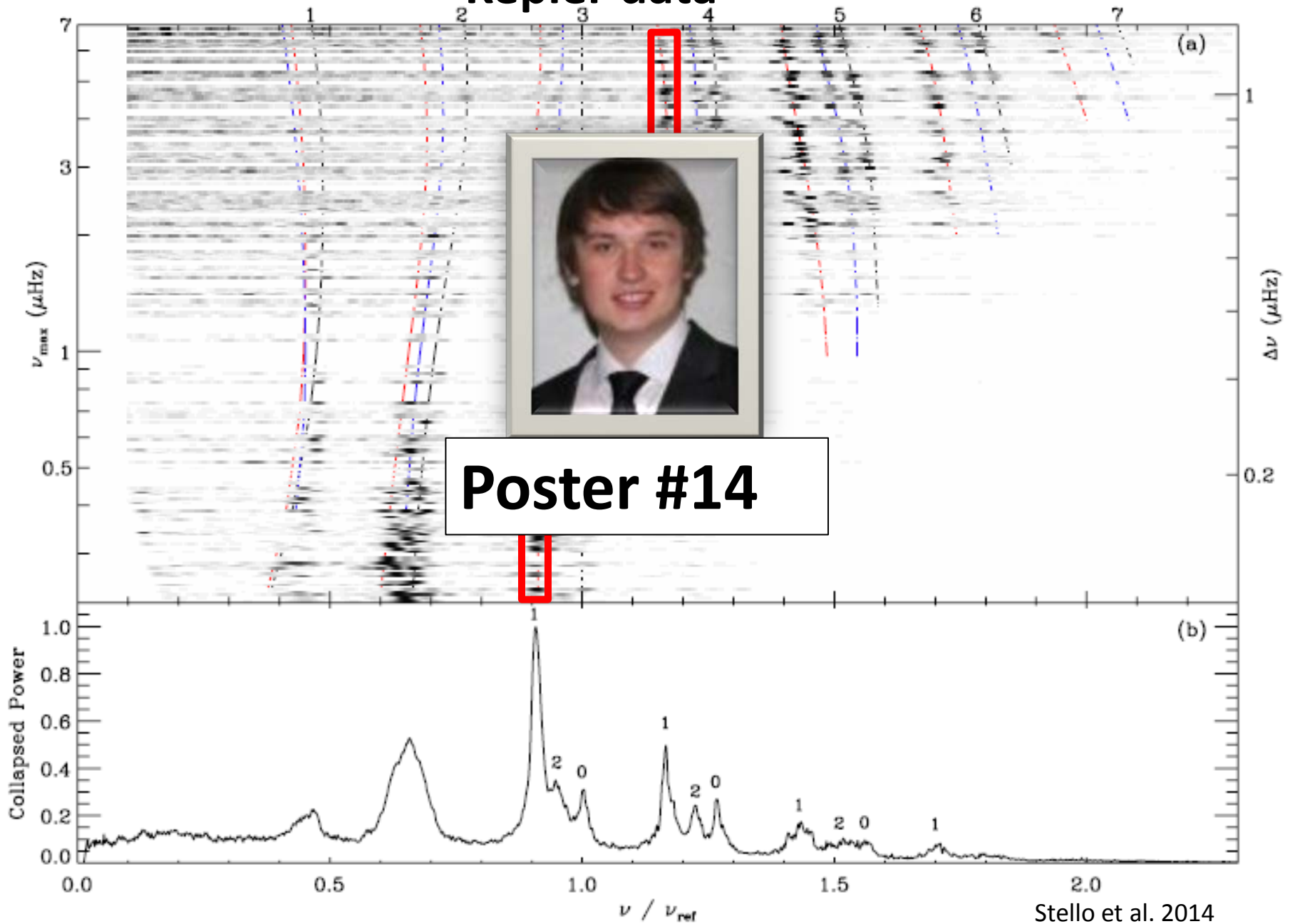
Kepler data



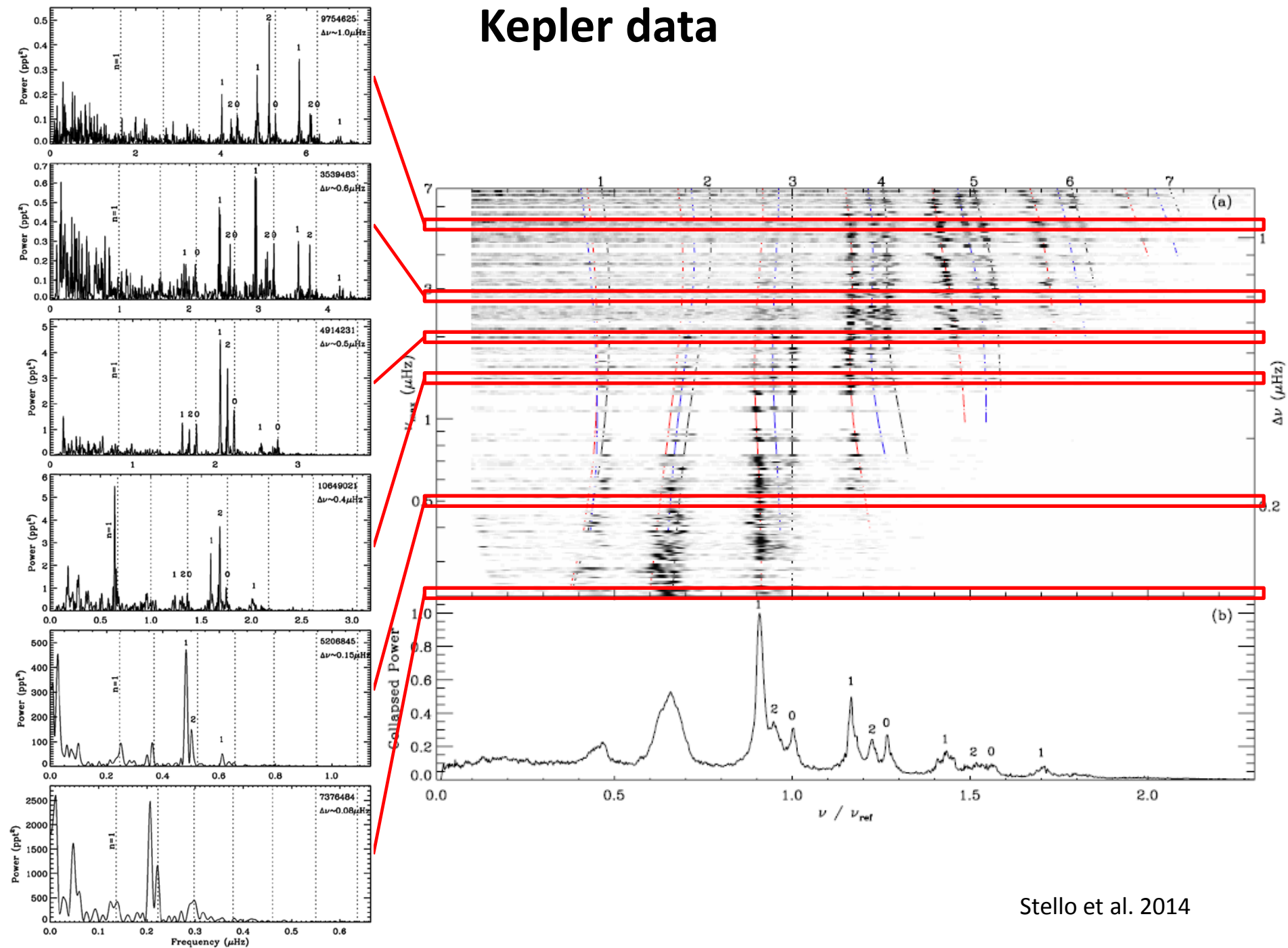
Kepler data



Kepler data

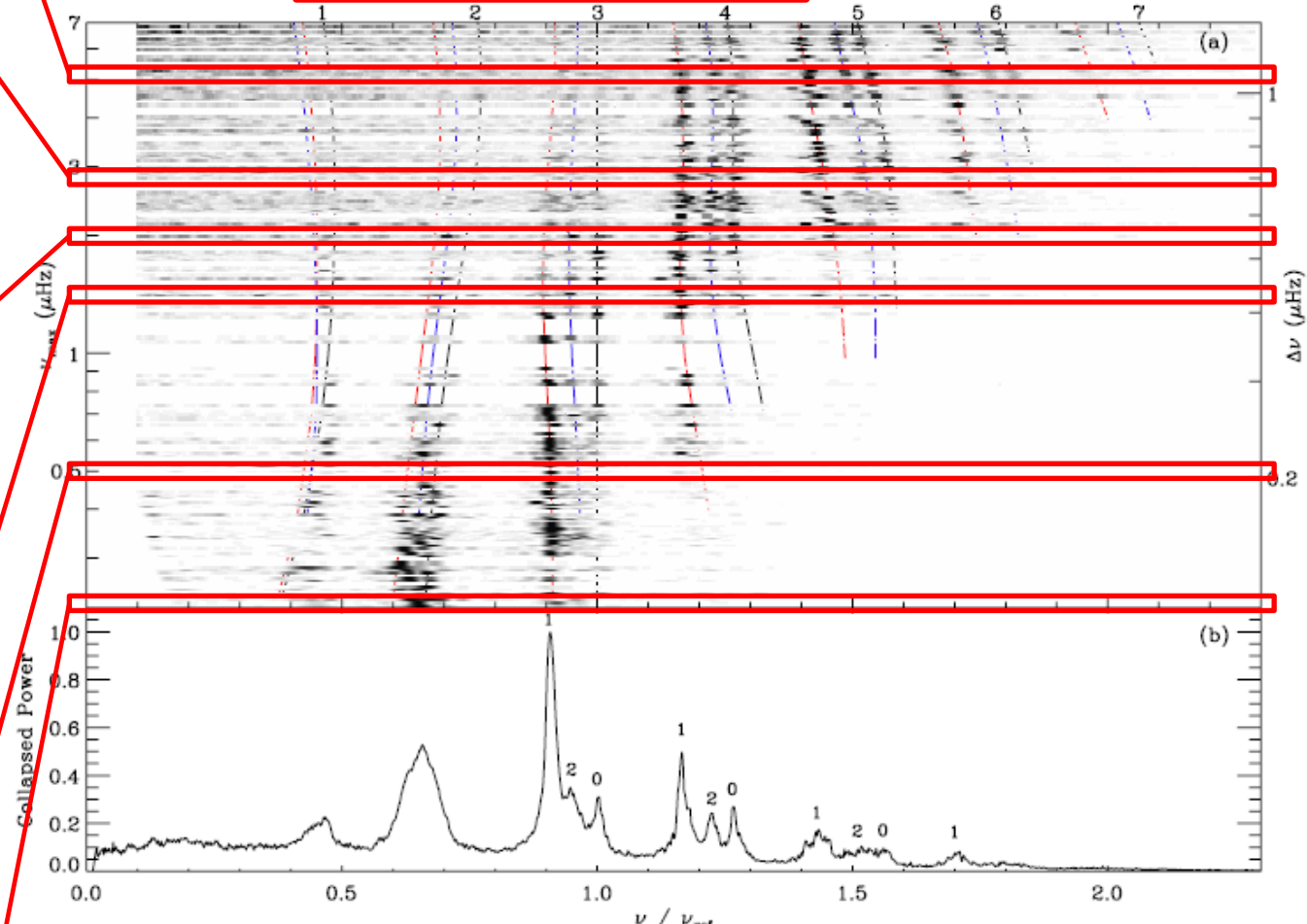
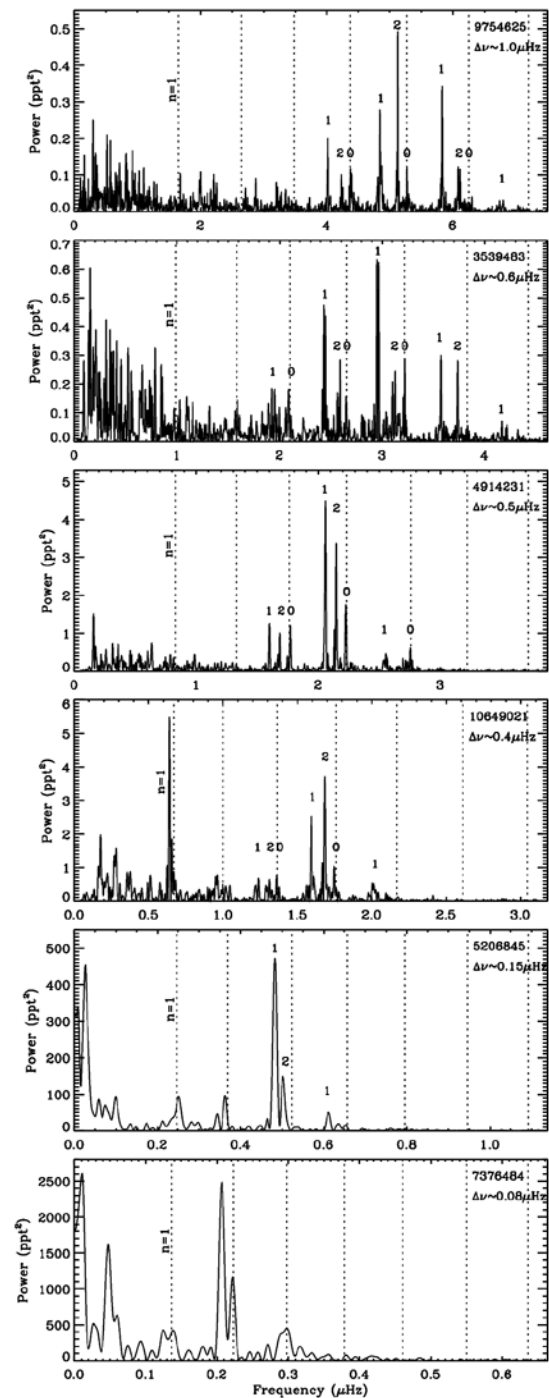


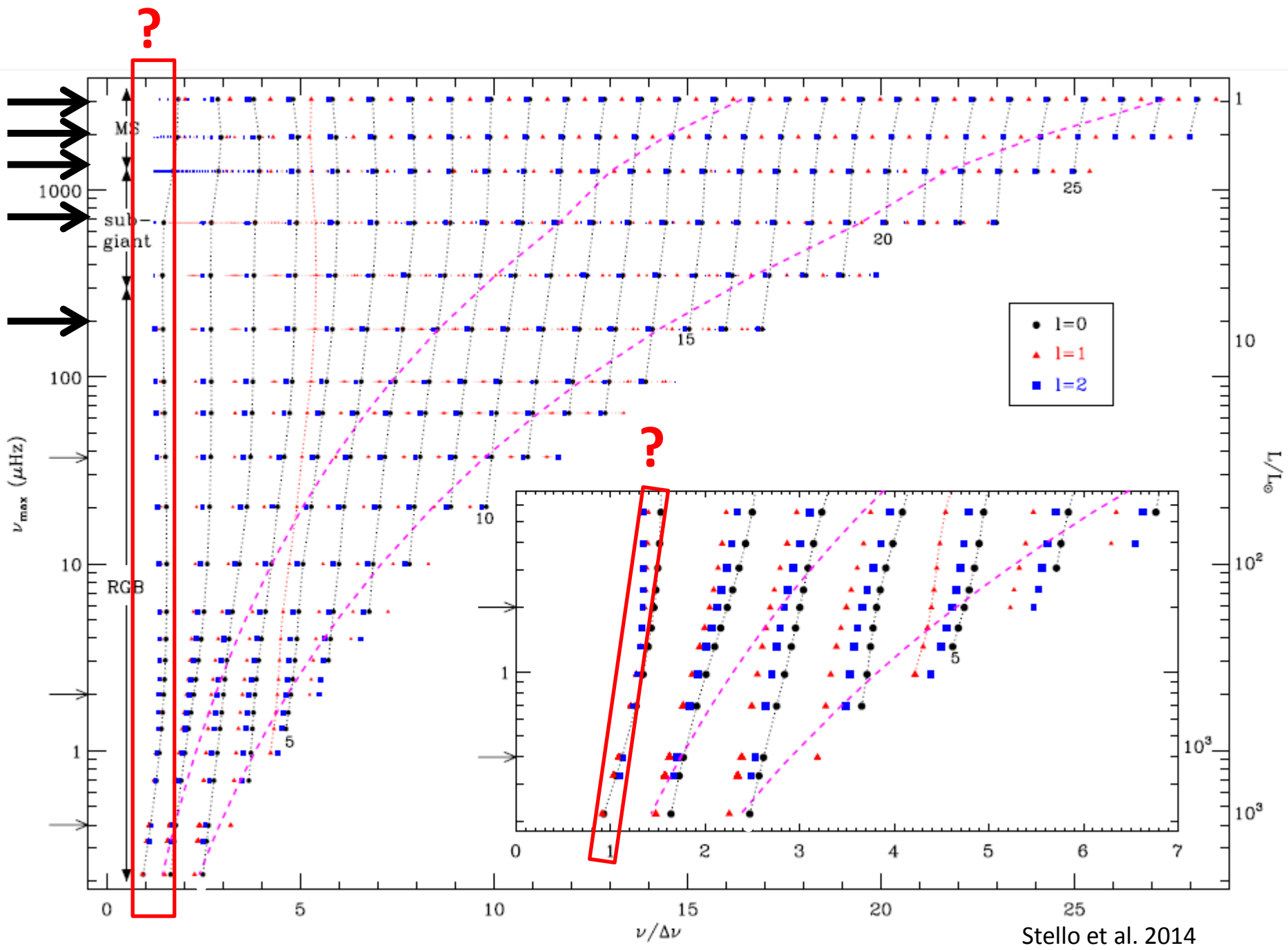
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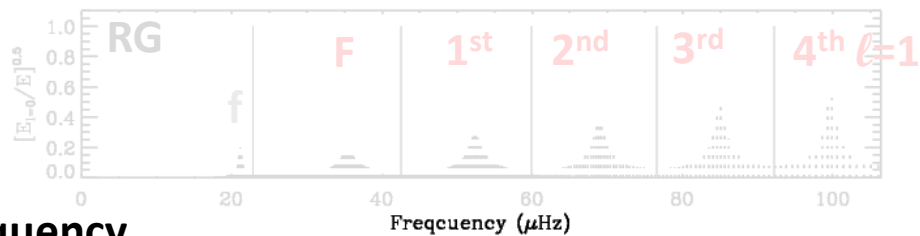
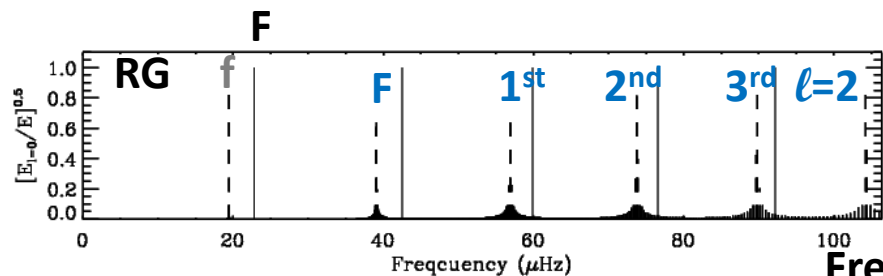
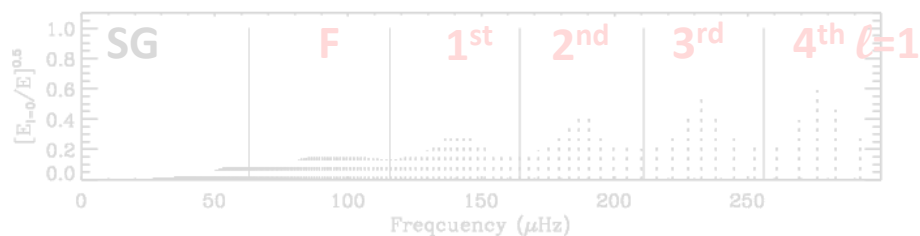
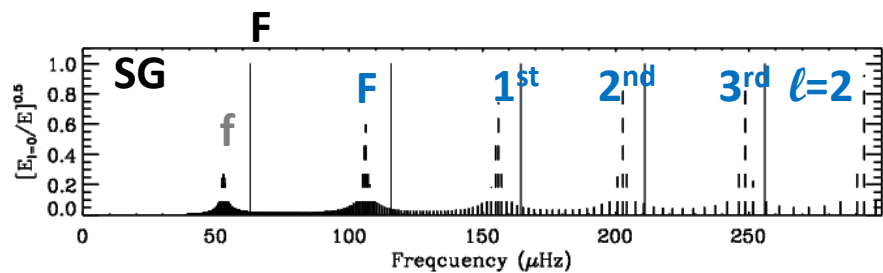
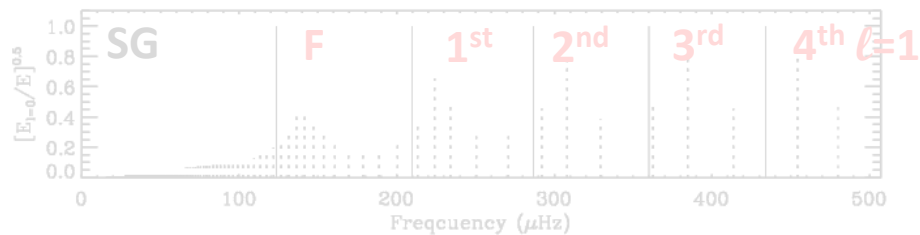
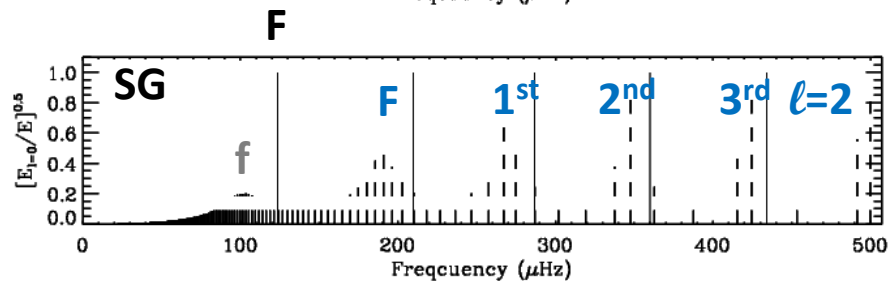
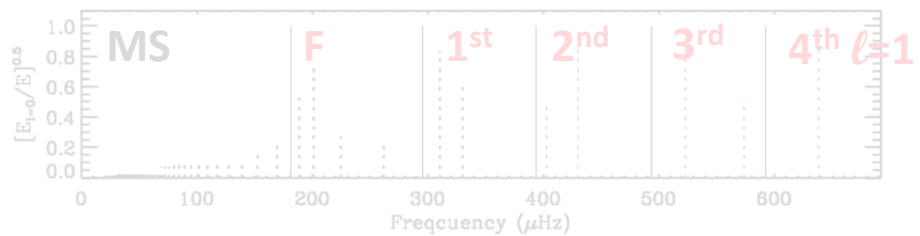
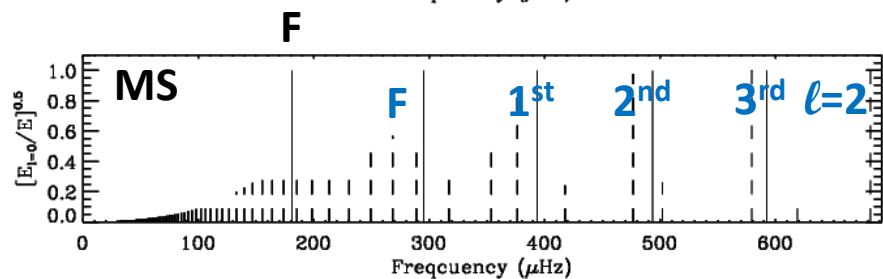
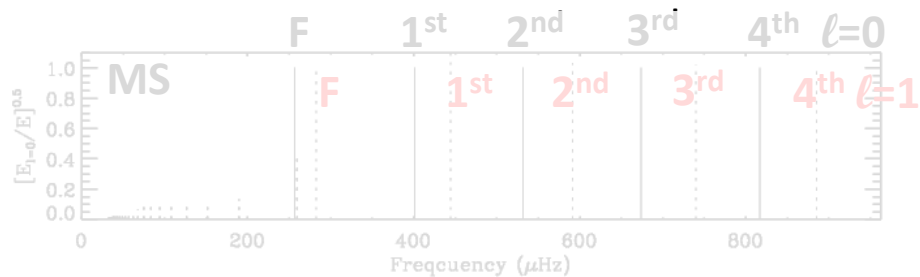
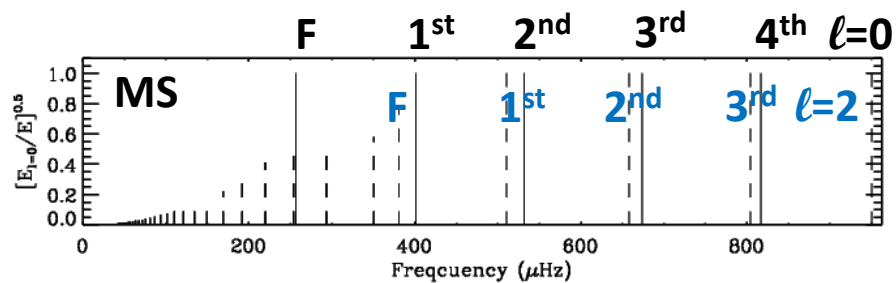
Kepler data

$$v_{nl} \cong \Delta v \left(n + \frac{l}{2} + \varepsilon \right)$$



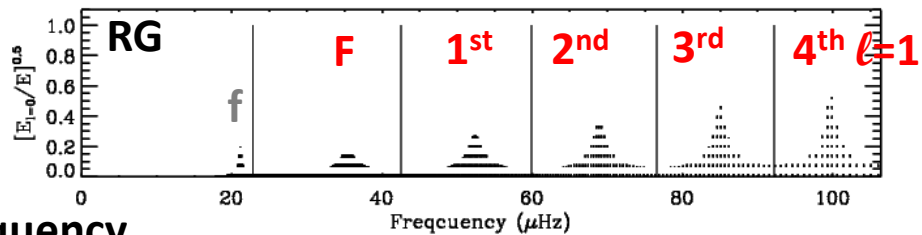
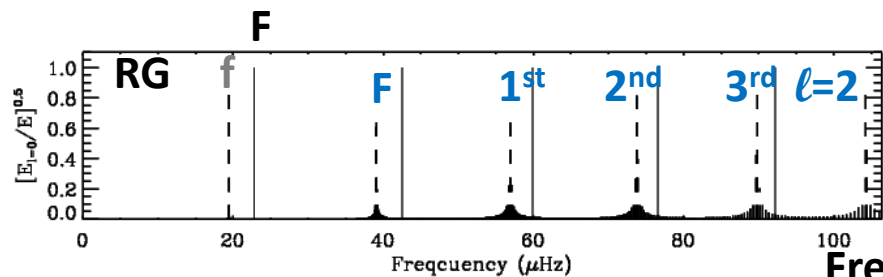
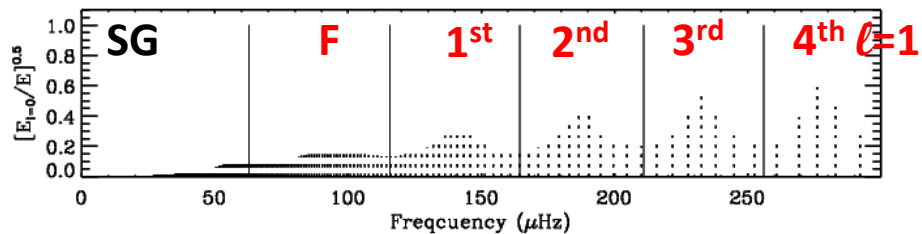
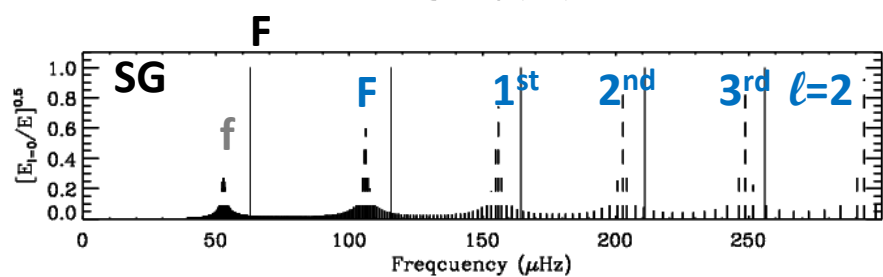
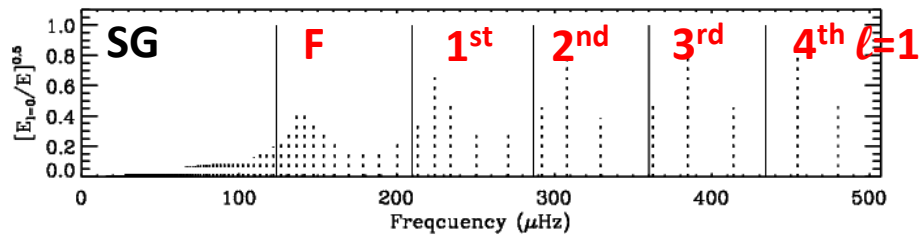
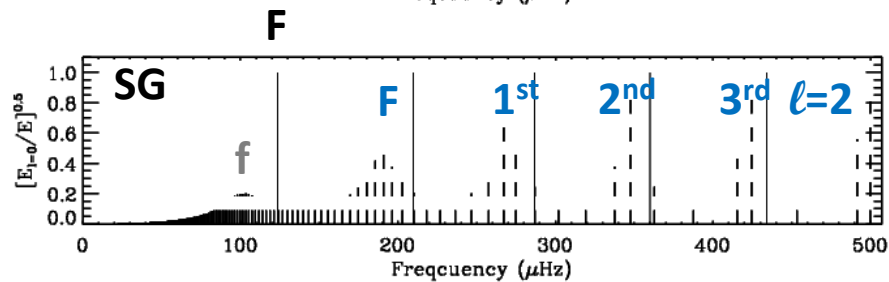
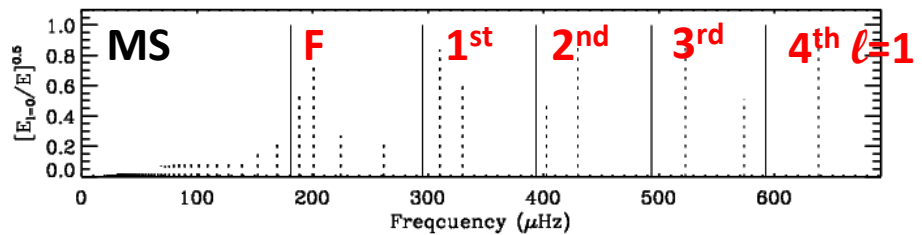
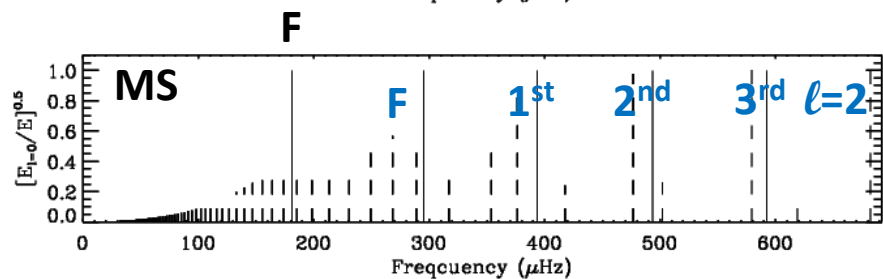
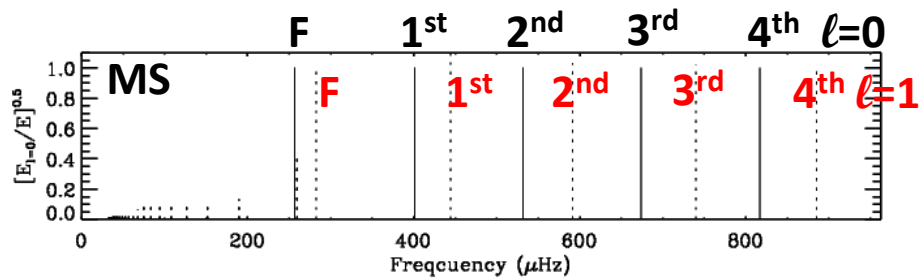
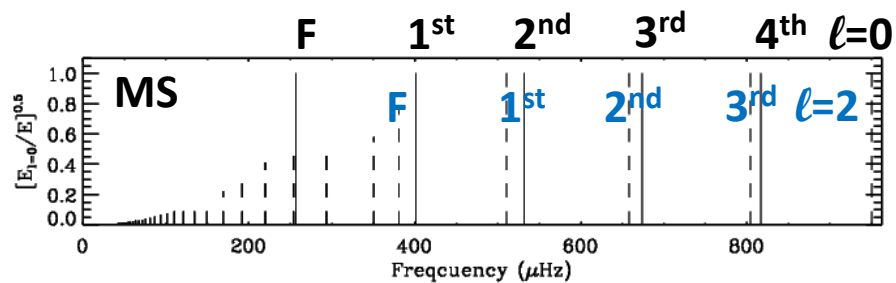


$(\text{Inertia}(\ell=0)/\text{Inertia})^{0.5}$




Frequency

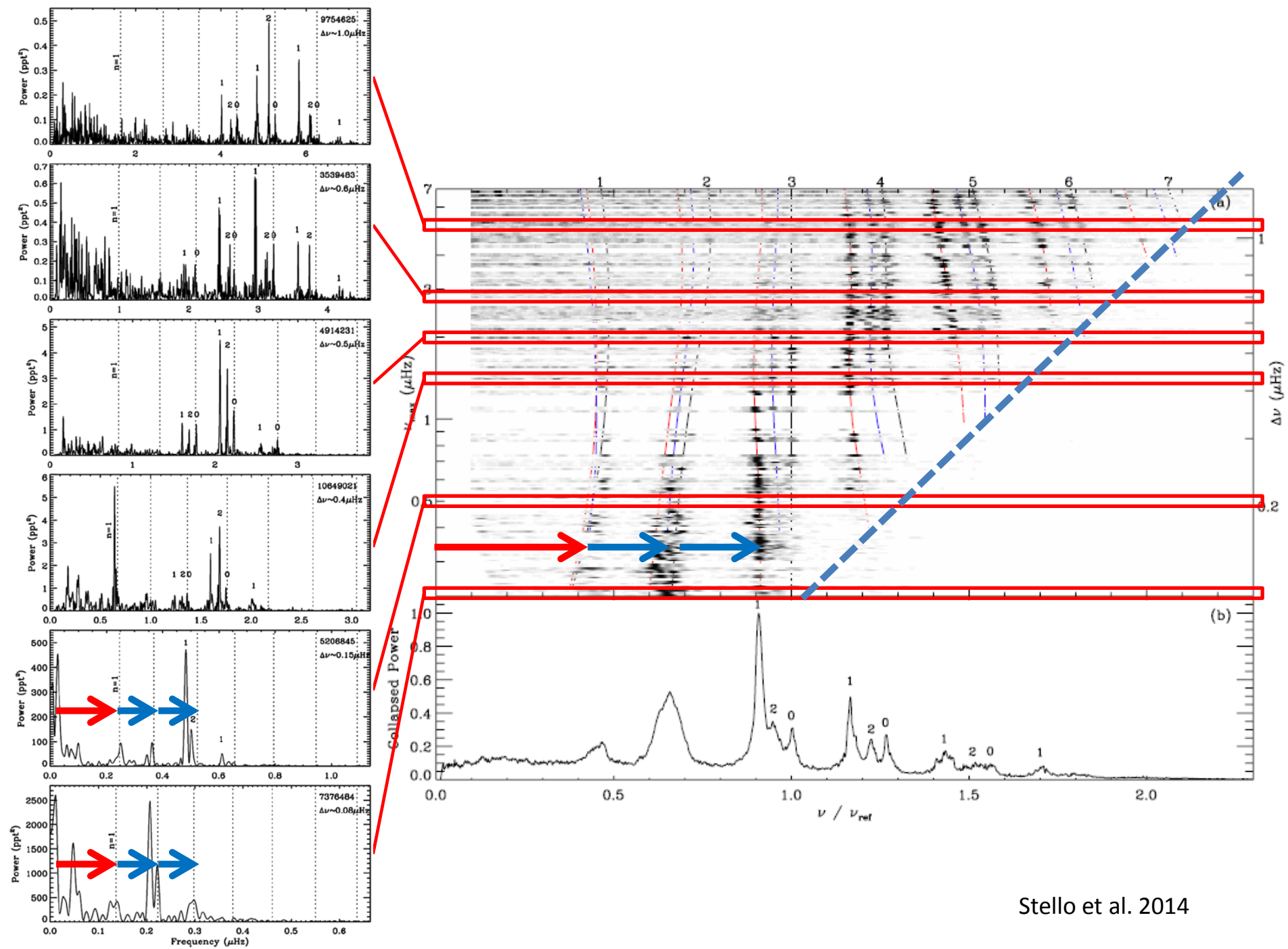
$(\text{Inertia}(\ell=0)/\text{Inertia})^{0.5}$

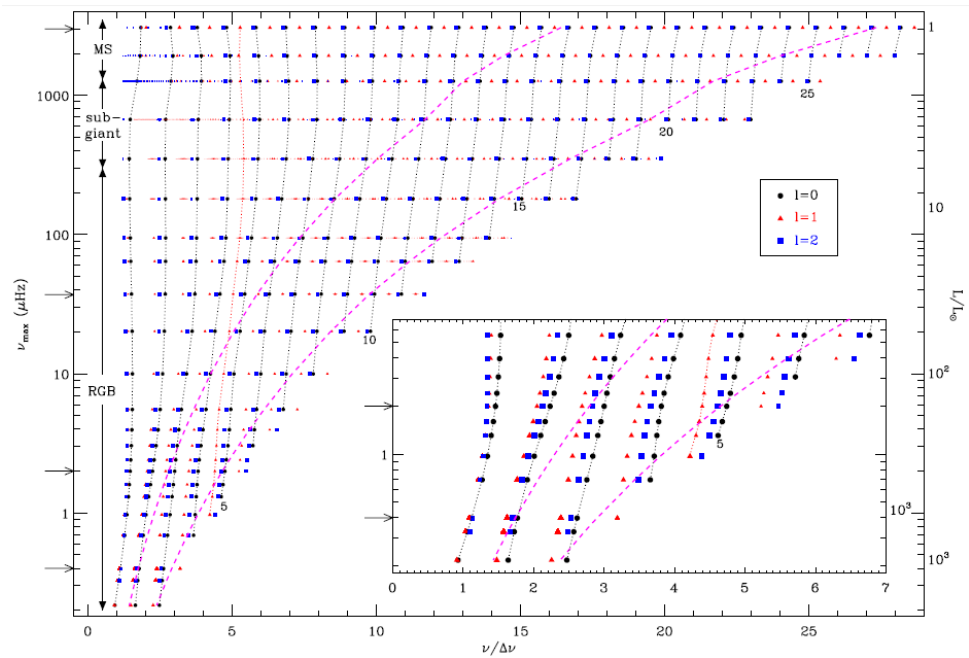


Frequency

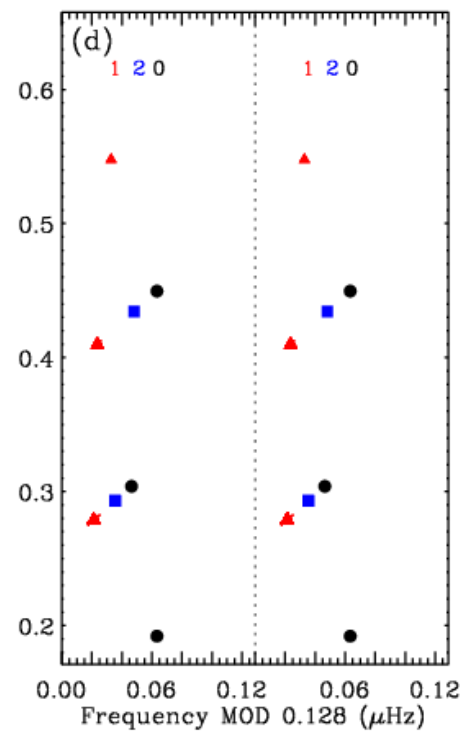
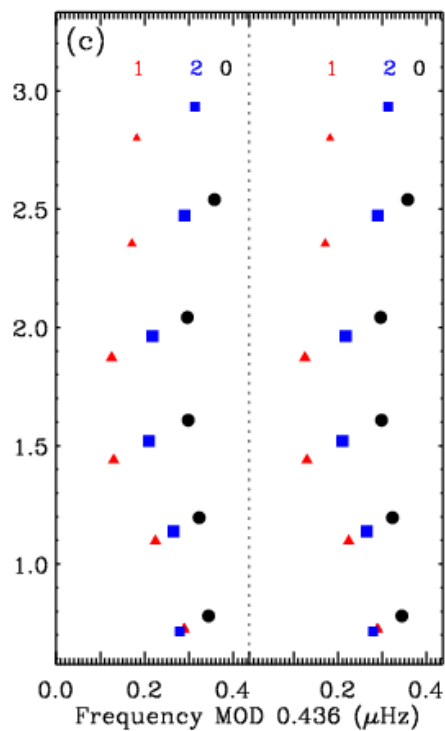
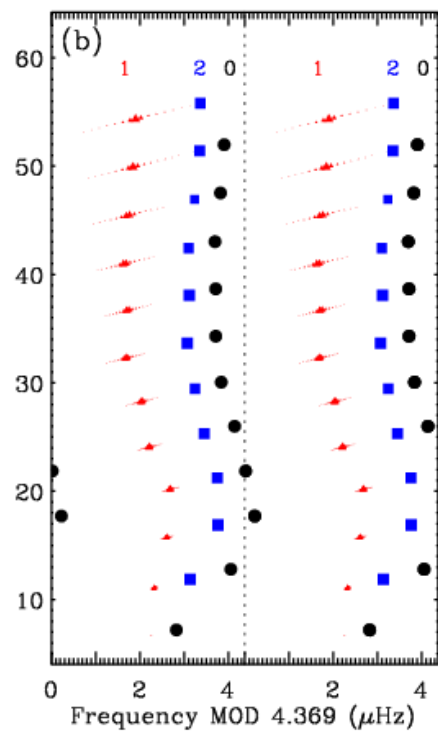
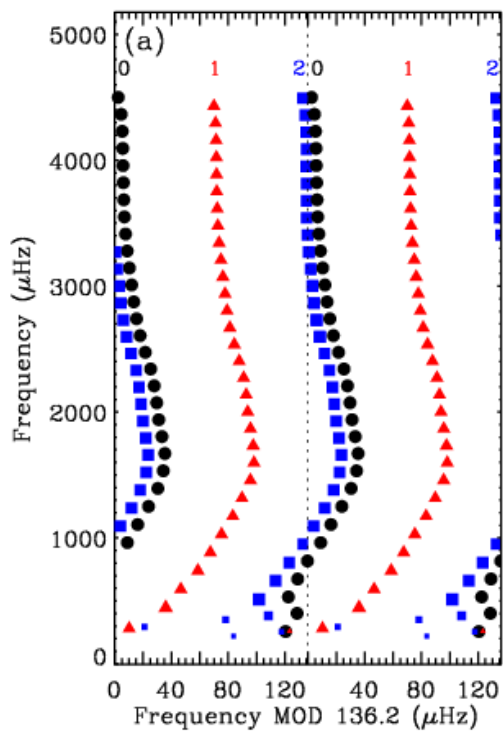
...in summary:

- M giants are cool!
- and really really big!!
- Triplet frequency pattern
-  explains structure in the Petersen and P-L diagrams
- Dipole modes dominate, why?
- Puzzling dipole 'f'-modes?





Stello et al. 2014



Kepler data

