Preface

Finding inspiration for a thesis topic is not a hard task with data from the Kepler Space Telescope. They are so abundant, so rich that they can probe many astrophysical questions. The difficulty lies in the agony of choice: how does one select a single topic on which to focus? Ultimately, the quandary I most often faced in writing this thesis was whether to delve deeper into a given topic, or to provide a broader coverage of more topics relevant to A-type stars. My primary inspiration for this was Wolff's (1983) monograph on the A stars. I wanted to emulate and update that authoritative and encompassing work by reviewing the literature and applying my inferences to examples, using A stars observed by *Kepler*.

With 30 years of progress since Wolff's monograph, it was impractical to expand upon everything Wolff wrote about. Instead, I chose to investigate the topics I found most interesting, where I thought more could be learned about the important physical processes operating in the A stars.

One such process is rotation. Angular rotational velocities reach their maximum at a spectral type of about A5, but slowly rotating A stars are also seen, most of which are chemically peculiar. Rotational braking in the presence of a strong magnetic field is understood as the mechanism causing slow rotation in the Ap stars, nevertheless too few magnetic, chemically normal progenitor stars to the Ap stars are observed. I scoured the literature to find a suitable class of candidates for the 'missing' Ap progenitors.

My journey into the literature on classes of peculiar stars did not end there. I became captivated by the λ Boo stars, which show underabundances of refractory elements. In this thesis, I reason that the two main theories for these underabundances both imply that the λ Boo stars contain a high fraction of pulsators—a suggestion that is supported by observations in the literature. Many λ Boo stars also have circumstellar material, suggesting they are potential planet hosts. Indeed, this is exemplified by HR 8799—a λ Boo star possessing four directly observed planets. The combination of planets and pulsations makes the λ Boo stars prime targets for detailed investigation with *Kepler*.

Pulsation is a recurring theme throughout the thesis. I take an unusual path and devote a lot of time to the non-pulsating stars in the δ Sct instability strip. These stars, without appreciable granulation or stellar winds, are probably the least variable objects on the HR diagram. They also have the potential to be among the most peculiar Am stars.

The detailed review of the literature is matched with thorough investigation of *Kepler* data and their applicability to the study of A stars. Through toil I learned how classical information theory was relevant to these data and how we use that to our advantage. The discovery that *Kepler*'s orbital motion periodically modulates the sampling on board the satellite and alleviates all Nyquist ambiguities in the data was the pinnacle achievement of this exercise, and has opened up study of many hundreds of stars previously thought to have insurmountable Nyquist ambiguities in their data.

I hope the reader will be as eager as I was in this learning, and will find the material in this thesis as useful a reference as I already have in the year since I began writing it.

Springer

http://www.springer.com/978-3-319-09416-8

Investigating the A-Type Stars Using Kepler Data
Murphy, S.J.
2015, XVII, 204 p. 121 illus., 73 illus. in color.,
Hardcover
ISBN: 978-3-319-09416-8