

MAPPING THE CONVECTION ZONES OF GAMMA DORADUS AND DELTA SCUTI VARIABLES

Mike Montgomery
University Of Texas, Austin
GO40042

We propose to use the nonlinearities present in the light curves of large-amplitude Gamma Doradus and Delta Scuti variables to constrain the depth of their convection zones. The basis of this technique is the strong temperature dependence of stellar convection zones: relatively small variations in the surface temperature due to pulsation can result in large changes in the size of the convection zone during a pulsation cycle, and this in turn introduces nonlinearities into the light curves. This technique has been successfully applied to pulsating white dwarf stars and should be straightforward to apply to the Gamma Doradus stars since both types of variables are g-mode pulsators. Additionally, we plan to extend this analysis to the high-amplitude Delta Scuti stars (HADS). Since they are p-mode pulsators we will need to include the change in radius in our modeling, although the fact that these stars are dominated by radial modes ($l=0$) will greatly simplify the analysis. Furthermore, we seek to monitor changes in the convection zones of these objects over multiple epochs. We therefore request continuing long-cadence observations for three Gamma Doradus stars and one month each of short-cadence monitoring of two Delta Scuti stars in the upcoming Kepler observing cycle. For the Gamma Doradus variables there are at present two competing proposed mechanisms for the source of mode driving based on completely different assumptions regarding the physics of convection in these objects; our analysis will help resolve this long-standing question. For the Delta Scuti Stars our analysis will provide important constraints on these difficult to model objects. Finally, we note that our approach is one of only two techniques that can be used to measure the depth of the convection zone of a pulsating star, and it is the only one available for stars such as the Gamma Doradus and Delta Scuti variables. As a result, this investigation will provide important data with which to test the results of hydrodynamical simulations of convection in this part of the HR diagram.