Observational Detection of Solar g-mode Oscillations Using Doppler Velocity Signals

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The purpose of the project was to detect solar g-modes which would consequently confirm existing theories of solar magnetic fields. Viable sunspots were selected based on set criteria, and data was collected from the archives of VSO. Using IDL software, a stack of the sunspot's doppler velocity images was made. An additional stack was then made of a quiet area of the Sun (region without a sunspot) which served as the control. Once the stacks were composed, they were collapsed from an array of data to a time sequence by totaling the value of the stacks in both the x- and y-direction in IDL. A Fast Fourier Transform was taken of the totaled stacks, multiplied by its complex conjugate, and plotted. The plots of the sunspot and the quiet Sun were then analyzed for differences. For the detection of g modes, the frequency of the Alfven waves that we expected to detect was 220 μHz (Garcia et al., 2008). When analyzing the plot of the quotient of the sunspot and the quiet Sun, a surplus of power was observed at a frequency very close to that of 220 μHz (269 μHz). Such a surplus was proven to be statistically significant offering a level of confirmation for our hypothesis. Despite this detection however, the results are inconclusive, and we cannot confirm the detection of gravity waves at the tachocline of the Sun due to a lack of analyzed data. The analysis of more data can support results and confirm our hypothesis.

Awards Won:
Third Award of $1,000