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Mode identification of oscillations of Delta Scuti type stars using high temporal resolution Kepler data

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Asteroseismology is the astrophysical science that studies the oscillations in the light curves of variable stars to understand the internal stellar structure. This research aimed to construct light curves from the Kepler mission data and calculate basic internal properties of the selected stars by analyzing the modes of the stars. Accordingly, photometric data of Kepler mission are taken to conduct an asteroseismic investigation on three chosen Delta Scuti type variable stars. The names given from the Kepler catalogue for the selected Delta Scuti stars are KIC 4048494, KIC 4077032 and KIC 8623953. To conduct the research on the star KIC 4048494, two months of short cadence data were taken; for the star KIC 4077032, one month of short cadence data was taken; for the star KIC 8623953, three months of short cadence data were taken. The data were taken from the KASOC database and further corrections to eliminating photometric outliers were performed. These high-resolution data were used to construct power spectra that can resolve frequencies up to 1.16 μHz. Light curve analysis for each of the variable stars is conducted and presented. The pulsation frequency modes were determined using the Period04 software which is a C++/Java based program, dedicated to statistical analysis of large astronomical time series. There are numerous unknown oscillation types which exist for the Delta Scuti type variable stars. The main frequency identification and determination of frequency combinations were done and the pulsation constant (Q) for each and every frequency was calculated. The radial fundamental mode of each star was determined by observing their period ratios and considering their amplitude variations. The resulted frequencies of fundamental radial modes for the stars KIC 4048494, KIC 4077032 and KIC 8623953 were redefined as 127.992±0.005 μHz, 73.048±0.014 μHz and 315.473±0.004 μHz, respectively.

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