



Determination of the g-modes of three Delta Scuti variable stars using Kepler data

R.D.D. Jayatissa¹, J. Adassuriya^{2*}, M.L.C. Attygalle¹ and K.P.S.C. Jayaratne²

¹Department of Physics, University of Sri Jayewardenepura, Nugegoda, Sri Lanka

²Astronomy and Space Science Unit, Department of Physics, University of Colombo, Sri Lanka

Asteroseismology is a study of stellar interiors using their surface pulsations. It is one of the best methods to do such studies where oscillations are analyzed to detect modes of stellar pulsations. There are two pulsation modes, pressure modes (p) and gravity modes (g). The buoyancy is the restoring force for g-mode, and the gas motions are primarily horizontal. The frequencies of g-modes are less than five cycles per day. These g-modes are concentrated more at the core of the star and used to determine the amount of core hydrogen in the stellar. Hence, the stellar age, internal rotation, and gas mixing can be obtained. In this study, frequency analysis was done for three Delta Scuti pulsating stars KIC 71195304, KIC 9775454, and KIC 10536147 using the long cadences data sets obtained from the KASOC database. The pulsation frequencies of the targets were determined by applying discrete Fourier transformation with the pre-whitening process. The Échelle diagrams were plotted to determine the degrees (l) of detected frequencies according to the frequency spacing. The dominant g-mode fundamental frequency for the target Delta Scuti Star, KIC 71195304 was determined as $4.19379761 \text{ d}^{-1}$ accompanied by a frequency multiplet where the non-radial frequencies of $l = 1$ triplet with the frequency spacing of 0.004 d^{-1} were detected. In this study, twenty-three g-mode frequencies were detected for KIC 71195304. Furthermore, the dominant p-mode fundamental frequency was determined as $14.9382253 \text{ d}^{-1}$ for the target KIC 9775454 accompanied by a frequency multiplet where the non-radial frequencies of $l = 1$ triplet with the frequency spacing of 0.004 d^{-1} were detected. There were nineteen g-mode frequencies detected for the target KIC 9775454. The dominant g-mode fundamental frequency was recovered as $0.21985058 \text{ d}^{-1}$ for KIC 10536147 with nine more g-mode frequencies. All three Delta Scuti stars have g-mode frequencies and further investigations should be recommended.

Keywords: Asteroseismology, Delta Scuti stars, gravity modes, light curves, photometry

E-mail: janaka@phys.cmb.ac.lk