Asteroseismic analysis of the polluted white dwarf G29−38 with *TESS*

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Abstract

The DAV G29-38 (TIC422526868) is one of the brightest ($V = 13.1$) and closest ($d = 17.5$ pc) white dwarfs that was observed by the *TESS* spacecraft. The *TESS* data set spans ~ 23 days, and from this we extracted more than 25 significant pulsation frequencies using a standard pre-whitening procedure. All the oscillation frequencies that we found are associated with g(gravity)-mode pulsations, with periods spanning from 240 s to 1200 s. We apply standard seismic tools for mode identification, including asymptotic period spacings and rotational frequency multiplets. Using the g-mode rotational splitting multiplets, we derive a rotation period of about 1.2 days, in agreement with previous determinations. Based on the values obtained from Kolmogorov-Smirnov and Inverse Variance statistical tests, we search for a constant period spacing for dipole ($\ell = 1$) and quadrupole ($\ell = 2$) modes. We find a constant period spacings of 39.47 s for $\ell = 1$ modes and 25.53 s for $\ell = 2$ modes, which allow us to constrain its stellar mass and the harmonic degree of the modes. We identify 15 $\ell = 1$ modes with radial order k values ranging from 10 to 34, and 7 $\ell = 2$ modes with k values between 22 and 44. Furthermore, we detected 24 combination frequencies. We perform period-to-period fit analyses and find an asteroseismological model with mass and effective temperature that are in good agreement with those derived from spectroscopy. Seismological models allow us to estimate also the seismological distance and compare it with the precise astrometric distance measured with *Gaia*.