Pulsating white dwarfs in the Kepler field

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Abstract

White dwarfs, dense stellar remnants composed of electron degenerate cores surrounded by diverse non-degenerate envelopes, are the end point of the majority of stars in the Universe. Our knowledge of the galactic white dwarf population has increased substantially thanks to large sky surveys such as SDSS. However, the understanding of their formation and evolution remains incomplete. It is therefore crucial to expand the known sample of white dwarfs, whether single or in binaries. As white dwarfs cool, they go through instability strips by exhibiting periodic variations about the mean intensity of their light. Asteroseismology can probe the interiors of white dwarfs and provide an insight on their compositions, rotation period, magnetic field strength, mass, temperature and luminosity, by studying their pulsations. Despite the fact that the Kepler mission provides the best ever time series photometry with an enormous impact on all areas of stellar variability, its field lacked one class of stars in its list of successful discoveries and studies: white dwarfs. Here we present our deep optical photometric survey of the Kepler field in U, g, r, i, as well as H-alpha, down to 21st magnitude: the Kepler-INT Survey (KIS, Greiss et al. 2012). It was mainly produced for the search of various types of targets such as hot, young, or active stars, white dwarfs or subdwarfs, and accreting objects. We will emphasize on our search for pulsating white dwarfs in the field by presenting our selection method and our results. We made use of the U and H-alpha filters to select our white dwarf candidates since they are hot, compact objects and therefore have blue colours. Also, their broad H-alpha absorption lines place them within the H-alpha deficit sources in colour-space. For the first two years of the mission, only two pulsating white dwarfs were found. We discovered an additional 10 new pulsating white dwarfs and obtained Kepler data for four of them. Our first discovery was presented in Greiss et al. (2014), who show the extremely high-quality Kepler data and preliminary asteroseismic results on this star. The clear splitting of some pulsation modes provide precise indications on the rotation period of the star. We will also present the Kepler data of the three other pulsating white dwarfs (Greiss et al. in prep).

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