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Stellar Magnetism Through the Instability Strip

While it is well understood that magnetic fields impact stellar evolutionary paths, the magnetic properties of evolved stars remain poorly constrained observationally and theoretically. Due to changes in internal structure and the formation of partial ionization zones, evolved stars will pass through instability regions in the Hertzsprung–Russell diagram where radial pulsations are excited. Several distinct stellar classes arise in these instability regions including classical Cepheids (intermediate and high mass) and Type II Cepheids (low mass). In particular, the classical Cepheids are famous for the well-correlated relationship between their pulsation period and luminosity. Despite being the subject of long-standing study, we know little about the photospheric magnetic fields of Cepheids, including their origin, incidence, topology and relationship to atmospheric dynamics. To address this, we have initiated a spectropolarimetric observational campaign to detect and characterize the magnetic fields of the brightest twenty-five classical Cepheids. We find that magnetic fields can be commonly detected in classical Cepheids when observed with sufficient precision. The Stokes V magnetic signatures are distorted, indicating that they are affected by complicated atmospheric dynamics. We show early results from our survey and discuss prospects for modelling the distorted Stokes V signatures. We discuss our ongoing observational campaign to perform a ZDI mapping of Polaris, the first for any Cepheid. We also highlight our recent magnetic detection in kappa Pav, the first magnetic detection in a W Vir Type II Cepheid. We conclude by raising critical open questions including the uncertain origins of Cepheid magnetic fields.