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Surface Signatures of Subsurface Magnetic Fields: Written on the Stellar Atmospheric Waves[1] BINDESH TRIPATHI, University of Wisconsin-Madison; NORDITA, DHRUBADITYA MITRA, NORDITA, KTH Royal Institute of Technology and Stockholm University, Roslagstullsbacken 23, SE-10691 Stockholm, Sweden — Internal dynamo-generated magnetic fields in the stars are inaccessible to direct observations, thus deterring our understanding of their origin and evolution in time. A tool that has proved very useful in analyzing the stellar interiors, called asteroseismology, however, has not yet been able to provide details of internal stellar magnetic fields. Here, we investigate the signatures of subsurface magnetic fields in the dispersion relations of acoustic waves (trapped near the stellar surface). We first begin with an isothermal, stratified atmosphere, permeated by a non-uniform (exponential function of the vertical coordinate) horizontal magnetic field (Ref: arXiv:1812.06947). We solve the problem exactly. Next we consider a more realistic polytropic atmosphere. We calculate the dispersion relation numerically and perturbatively. We show that the presence of a horizontal magnetic field breaks the symmetry of rings of constant frequencies over the horizontal wavenumbers. Such asymmetry arising from the magnetic fields eludes the standard helioseismology with its present resolution. Our results hint that internal stellar magnetic fields might be possible to infer based upon stellar surface oscillations.

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