Differential rotation in Sun-like main-sequence stars

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Abstract

Understanding differential rotation of sun-like stars is of great importance for insight into the angular momentum transport in these stars. One means of gaining such information is that of asteroseismology. By a forward modeling approach we analyze in a qualitative manner the impact of different differential rotation profiles on the splittings of p-mode oscillation frequencies. The optimum modes for inference on differential rotation are identified along with the best value of the stellar inclination angle. We find that in general it is not likely that asteroseismology can be used to make an unambiguous distinction between a rotation profile such as e. g. a conical sun-like profile and a cylindrical profile. In addition, it seems unlikely that asteroseismolgy of sun-like stars will result in inferences on the radial profile of the differential rotation, such as can be done for e. g. red giants. At best one could possibly obtain the sign of the radial differential rotation gradient. Measurements of the extent of the latitudinal differential from frequency splitting are, however, more promising. One very interesting aspect that could likely be tested from frequency splittings is whether the differential rotation is solar-like or anti-solar-like in nature, in the sense that a solar-like profile has an equator rotating faster than the poles. In addition to the qualitative treatment of the impact of different differential rotation profiles we will also present quantitative estimates on the errors that could be obtained on the p-mode splittings. This is to ascertain if the detection and inversion of a latitudinal differential rotation profile is at all feasible from Kepler data.

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