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Effects of rotation and magnetic fields on the lithium abundance and asteroseismic properties of exoplanet-host stars

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Aims: The effects of rotation and magnetic fields on the surface abundances of solar-type stars are studied in order to investigate whether the reported difference in lithium content of exoplanet-host stars can be related to their rotational history. Moreover, the asteroseismic properties predicted for stars with and without exoplanets are compared to determine how such a scenario, which relates the lithium abundances and the rotational history of the star, can be further challenged by observations of solar-like oscillations. Methods: Based on observations of rotational periods of solar-type stars, slow rotators on the zero age main sequence (ZAMS) are modelled with a comprehensive treatment of only the shellular rotation, while fast rotators are modelled including both shellular rotation and magnetic fields. Assuming a possible link between low rotation rates on the ZAMS and the presence of planets as a result of a longer disc-locking phase during the pre-main sequence (PMS), we compare the surface abundances and asteroseismic properties of slow and fast rotating models, which correspond to exoplanet-host stars and stars without detected planets, respectively. Results: We confirm previous suggestions that the difference in the lithium content of stars with and without detected planets can be related to their different rotational history. The larger efficiency of rotational mixing predicted in exoplanet-host stars explains their lithium depletion and also leads to changes in the structure and chemical composition of the central stellar layers. Asteroseismic observations can reveal these changes and can help us distinguish between different possible explanations for the lower lithium content of exoplanet-host stars.

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