3D Realistic Modeling of Stellar Subsurface and Surface Dynamics as a Tool to Characterize Stellar Jitter

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Detection of the Earth-mass planets with the radial velocity method is challenging due to the significantly weaker contribution of the signal variations in comparison disturbances due to the stellar surface dynamics and activity (called the stellar jitter). Characterization of this signal and development of a procedure to efficiently remove it from radial velocity measurements are complicated tasks due to observational limitations. Current computational capabilities allow us to perform 3D radiative modeling of selected target stars from the first physical principles and mimic disk-integrated observables. We performed a series of 3D radiative models using the StellarBox code. The computational domain for each target star represents a small patch of the stellar surface that covers 12Mm of upper subsurface layers and 1Mm of the atmosphere. These simulations have been used to synthesize time series of iron lines at different locations on the stellar disk with ultra-high spectral resolution and investigate properties of the photospheric motions and their contribution to observables, as well as the potential to filter out the photospheric signal from observations.