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Imaging solar turbulent convection with inertial waves

The recent discovery of rotation-induced inertial waves on the surface of the Sun [1] promises to open a new branch of helio- and asteroseismology. Solar inertial wave observations, combined with linear eigenvalue analysis, can help us probe the internal rotation of the Sun, as well as the thermal structure of its convective envelope [2,3]. However, since inertial modes are stochastically excited by the highly turbulent flows occurring in the convective zone of the Sun, these observations also carry information about the turbulence autocorrelation spectrum all the way down to the base of the convective region.

In order to extract this invaluable information, it is necessary to be able to predict the power spectral density in the whole inertial frequency range, which requires a model for the stochastic excitation of the solar inertial waves by convective turbulence. In this presentation, I will outline how this can be achieved for purely 2D toroidal waves on a sphere, based on the formalism by [4], after which I will describe how our approach can be extended to the full 3D case.

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[2] L. Gizon, D. Fournier, and M. Albekioni, Astron. Astrophys., 2020, 642, A178
[3] Y. Bekki, R.H. Cameron, and L. Gizon, Astron. Astrophys., 2022, 662, A16
[4] J. Philidet, and L. Gizon, Astron. Astrophys., 2023, Astron. & Astrophys., 673, A124

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