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Otto Laporte Lecture: Flow in the Sun

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The flow in the outer 30% of the Sun is driven by turbulent convection. Careful estimates suggest that the global Rayleigh number is upwards of 10^{22} and the corresponding Reynolds number on the order of 10^{12}. And, in the middle of its life, the Sun is rotating only slowly. Does all this mean that the flow due to convection follow the standard lore of high-Reynolds-number turbulence? What challenges exist in understanding the flow features in the Sun? These questions remain only inadequately answered at present, but a brief perspective will be attempted, in part on the basis of the following papers.

[1] Anomalously weak solar convection, SM Hanasoge, TL Duvall, KR Sreenivasan, Proceedings of the National Academy of Sciences 109, 11928-11932, 2012
[2]. The quest to understand supergranulation and large-scale convection in the Sun, SM Hanasoge, KR Sreenivasan, Solar Physics 289, 3403-3419, 2014
[3]. Seismic sounding of convection in the Sun, S Hanasoge, L Gizon, KR Sreenivasan, Annual Review of Fluid Mechanics 48, 191-217, 2016
[4]. Large-scale turbulence in the Sun is suppressed and confined to equatorial regions, SM Hanasoge, H Hotta and KR Sreenivasan, Science Advances 6, eaba9639, 2019
[5]. Unusual dynamics of convection in the Sun, J Schumacher, KR Sreenivasan, Reviews of Modern Physics (in print)