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## The Sun's differential rotation is controlled by baroclinically-unstable high-latitude inertial modes

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Helioseismology has revealed that the Sun's differential rotation profile substantially deviates from the well-known Taylor-Proudman theorem. It has been postulated that this deviation arises because the poles are warmer than the equator by a few degrees. Recently, global inertial modes of oscillation have been observed and identified on the Sun, including high-latitude modes with  $m=1,2,3$ . These high-latitude inertial modes are baroclinically unstable and thus quite sensitive to the latitudinal temperature difference inside the Sun. In this talk (based on [Bekki, Cameron, & Gizon, Science Adv. 10:5643, 2024](#)), we use 3D nonlinear numerical simulations to show that the pole-to-equator temperature difference in the Sun's convection zone is limited to less than 7 K due to the nonlinear feedback of the high-latitude modes. It is also found that these inertial modes control the Sun's differential rotation by transporting heat equatorward and affecting the angular momentum balance. The observed amplitudes of these inertial modes indicate that the Sun's latitudinal differential rotation is near its maximum allowed value.

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