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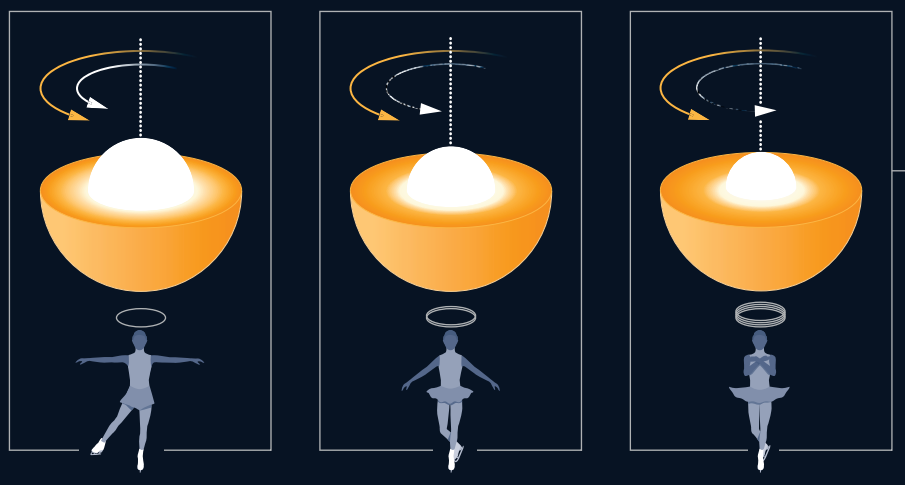
Star Spin Mystery

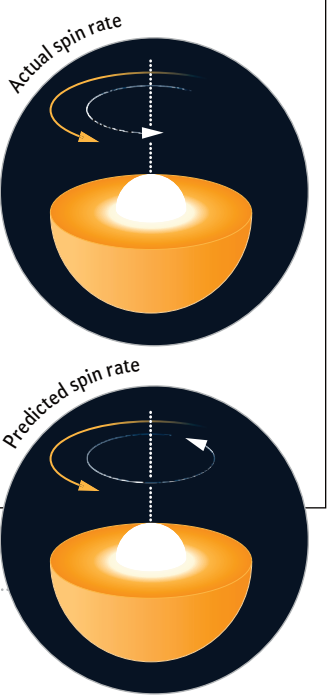
Scientists wondered why the insides of stars are spinning so slowly

Astronomers can measure how fast stars spin by observing "starquakes"—seismic tremors that are the equivalent of earthquakes on our planet. Yet these observations have posed a puzzle because many stars seem to be spinning slower than they should be. In a new study, researchers modeled how a magnetic field could grow in the internal layers of a star, dragging its rotation down.

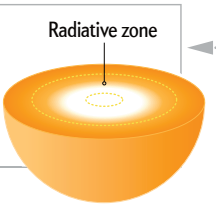
Many stars' cores contract at some point, especially toward the ends of their lives when they have ceased fusing hydrogen in their centers. Usually this contraction would speed up the star's spin, just as figure skaters will twirl faster when they pull their arms in. Concentrating more mass in a smaller space will force an object to speed up to preserve angular momentum.

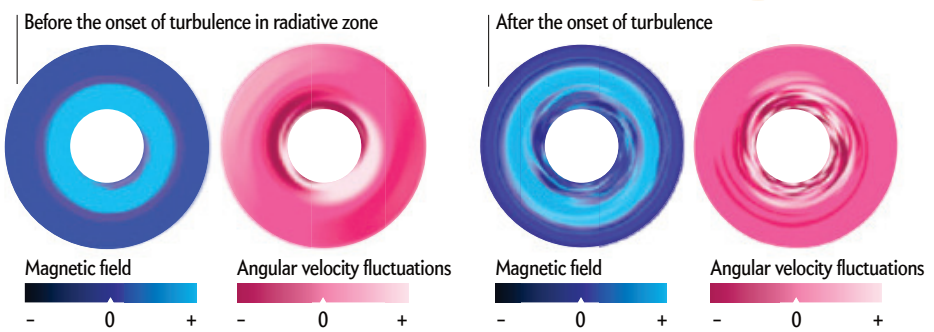


But the actual spin rate of many stars is slower than theory predicts, particularly in old stars.

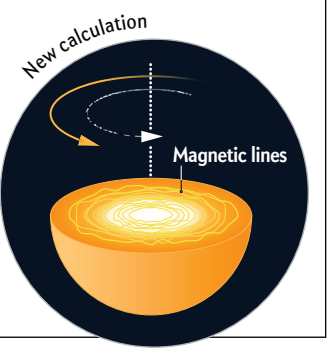


In a new numerical model, researchers found that a small, random magnetic field inside the radiative layer of a star could be amplified by the plasma's flow. Once strong enough, this magnetic field spurs turbulence in the star's plasma, which in turn strengthens the magnetic field, which boosts the turbulence, and so on.





This mechanism is compatible with observations of the spin rates of neutron stars and white dwarfs. It could possibly occur within the sun's radiative zone as well.



This magnetic force exerts a powerful torque on the star's plasma, slowing its spin. "It causes a breaking effect," says Florence Marcotte, a scientist at Côte d'Azur University in France, who co-authored the study published in *Science*.

Source: "Spin-Down by Dynamo Action in Simulated Radiative Stellar Layers," by Ludovic Petitdemange, Florence Marcotte and Christophe Gissinger, in *Science*, Vol. 379; January 20, 2023 (*reference*)