Available energy and its relation to turbulent transport

R.J.J. Mackenbach[1], J.H.E. Proll[1], P. Helander[2]

[1]Eindhoven University of Technology, 5612 AZ Eindhoven, The Netherlands
[2]Max Planck Institute for Plasma Physics, 17491 Greifswald, Germany

r.j.j.mackenbach@tue.nl

Any collisionless plasma possesses some "available energy" (AE), which is that part of the thermal energy that can be converted into instabilities and turbulence. Here, I present an investigation into the available energy carried by trapped electrons in a slender non-omnigenous flux tube of plasma. We compare this AE with gyrokinetic simulations of the non-linear saturated radial energy flux resulting from turbulence driven by collisionless trapped-electron modes in various stellarators and a tokamak. The numerical calculation of AE is extremely fast and shows a strong correlation with the turbulent energy fluxes found in the gyrokinetic simulations, resulting in a power law. Finally, we implement AE as a proxy for turbulence optimisation and investigate the resulting optimized devices.