CORONAL HEATING, MAGNETOHYDRODYNAMIC TURBULENCE AND SCALING LAWS

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I will describe long-time high-resolution simulations of the dynamics of a coronal loop in Cartesian geometry, within the framework of reduced magnetohydrodynamics (RMHD), to understand coronal heating driven by the motion of field lines anchored in the photosphere. MHD anisotropic turbulence is the physical mechanism responsible for the transport of energy from the large scales, where energy is injected by photospheric motions, to the small scales, where it is dissipated. As the loop parameters vary, different regimes of turbulence develop: strong turbulence is found for weak axial magnetic fields and long loops, leading to Kolmogorovlike spectra in the perpendicular direction, while weaker and weaker regimes (steeper spectral slopes of total energy) are found for strong axial magnetic fields and short loops. As a consequence the scaling of the heating rate with axial magnetic field intensity B , which depends on the spectral index of total energy for given loop parameters, must vary from$B^{3/2}$ for weak fields to B^2 for strong fields at a given aspect ratio. Extension to full MHD and realistic geometries will also be discussed.