ABSTRACT

The development of high power wave heating and current drive in magnetized plasmas in the last 40 years is a major ongoing success story in plasma science. A hallmark of this area of research has been the detailed quantitative comparison of theory and experiment; the good agreement consistently found is indicative of the robustness and the predictive power of the underlying theory. This tutorial paper is a brief overview of the fundamental concepts and applications of this branch of plasma science. Most of the high power applications have been in three frequency regimes: the ion cyclotron range of frequencies (ICRF), the lower hybrid range of frequencies (LHRF), and the electron cyclotron range of frequencies (ECRF). The basic physics of wave propagation and damping in these regimes is briefly discussed. Some of the coupling structures (antennas) used to excite the waves at the plasma boundary are described, and the high power systems used to generate the wave energy are touched on. Representative examples of the remarkably wide range of applications of high power wave heating and current drive in high temperature fusion plasmas will be discussed.