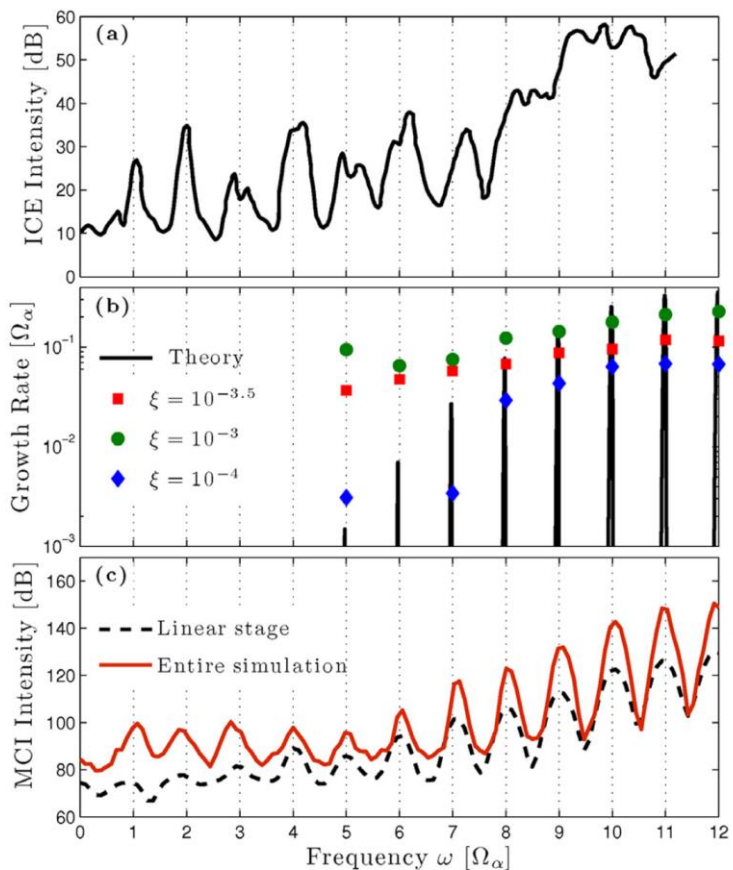


Fast particle-driven ion cyclotron emission (ICE) in tokamak plasmas & the case for an ICE diagnostic in ITER



(a) ICE spectrum in 1991 JET DT experiment
 (b) MCI growth rates from analytical theory & simulations
 (c) ICE intensity in kinetic ion/fluid electron simulation¹

¹ Carbajal et al. Phys. Plasmas **21**, 012106 (2014)

- ❑ ICE is passive, non-invasive & compatible with high radiation environment in ITER - provides important information on fusion α -particles & beam ions
- ❑ In JET ICE from fusion products \propto fusion reaction rate over 6 orders of magnitude; provided evidence that α -particle confinement was close to classical
- ❑ Magnetoacoustic cyclotron instability (MCI), driven by resonant interaction of fast ions with fast Alfvén waves, provides credible excitation mechanism
- ❑ Particle-in-cell & hybrid simulations used to model nonlinear stage of MCI¹
 - better comparison with measured ICE spectra, hence more effective exploitation as fast ion diagnostic
 - close correspondence between simulated & measured spectra (cf. top & bottom figures)
- ❑ **Could be implemented in ITER by installing dedicated probe (e.g. magnetic loop) or adding detection capability to ICRH antennae – simultaneous use for RF heating & ICE detection should be possible**