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High field side lower hybrid launch leads to wave amplification on alpha particles IAN OCHS, Princeton University, NICOLA BERTELLI, Princeton Plasma Physics Laboratory, NATHANIEL FISCH, Princeton University — Although lower hybrid waves have been shown to be effective in driving plasma current in present-day tokamaks, they are predicted to strongly interact with the energetic α particles born from fusion reactions in eventual tokamak reactors. However, in the presence of the expected steep α particle birth gradient, this interaction can produce wave amplification rather than wave damping. Here, we identify the flexibilities in achieving this amplification effect through a consideration of symmetries in the channeling interaction, in the wave propagation, and in the tokamak field configuration. Interestingly, for current drive that supports the poloidal magnetic field, we find that wave amplification through α channeling is fundamentally coupled to the elusive $|kl|$ upshift. In so doing, we show that wave launch from the tokamak high-field side is favorable both for α-channeling and for achieving the $|kl|$ upshift. We then present a simple linear model to calculate the required radial gradients to achieve amplification. Combining this model with ray tracing simulations, we demonstrate the potential for substantial wave amplification in a regime consistent with a hot-ion-mode fusion reactor.

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