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Local wave particle resonant interaction causing energetic particle prompt loss in DIII-D plasmas RUIBIN ZHANG, Fusion Simulation Center, School of Physics, Peking University, Beijing 100871, China, GUOYONG FU, ROSCOE WHITE, Princeton Plasma Physics Laboratory, Princeton, New Jersey 08543, USA — A new resonance mechanism is introduced to explain the observed first-orbit prompt beam ion losses induced by RSAE in the D3D tokamak [1]. Because of large banana width and localized radial structure, some trapped beam ions can only interact with RSAE on the inner legs of their banana orbits. A beam ion can interact resonantly with the RSAE when the mode phase is nearly constant within the local interaction region. We identify this strong local wave particle interaction as local resonance. The local resonance condition is determined by the local poloidal and toroidal velocity of beam ions and can be written as $< -m\dot{\theta} + n\dot{\phi} >_{gc} -\omega = 0$, where $<>$ denotes local time average within the interaction region and $_{gc}$ stands for guiding center coordinates. A full orbit test particle code FOST confirms the local resonance theory. Both the linear scaling with the mode amplitude and the frequency of the loss signals detected by FILD on D3D as well as the measured fast ion radial kick size can be well explained by this local resonance theory and simulation.

[1] X. Chen, et al, Phys.Rev.Lett. 110,065004(2013).

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