

## Harmonic plasma waves excitation and ring structure formation of intense ion beams in plasmas

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Understanding the transport of charged particle beams in background plasmas is important for fundamental physics as well as for scientific applications, such as high energy density physics the heavy ion fusion and recently plasma wakefield acceleration (PWFA). We investigated here the long-term dynamic evolutions of intense ion beams in plasmas with the two-dimensional electromagnetic particle code IBMP, taking into account the effect of the two-stream instability between beam ions and plasma electrons. Depending on the initial beam radial density profile and velocity distribution, ring structures may be formed in the beam edge regions. At the later stage of beam-plasma interactions, the ion beams are strongly modulated by the two-stream instability and multiple density spikes are formed in the longitudinal direction (as indicated in Fig. 1). The formation of these density spikes is shown to result from the excitation of harmonic plasma waves when the instability gets saturated.

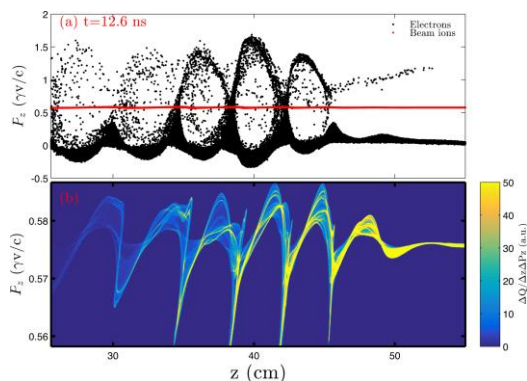


Fig. 1 Phase space distributions of beam ions and plasma electrons.

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### References

- [1] Zhang-Hu Hu and You-Nian Wang, *Physics of Plasmas* **23**, 083118 (2016).
- [2] Zhang-Hu Hu and You-Nian Wang, *Physics of Plasmas* **23**, 023113 (2016).