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Observation of space-charge field screening in plasma, and other recent experimental results from SPARC_LAB.

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The space-charge field of a relativistic bunch is screened in plasma due to the presence of mobile charge carriers. We experimentally investigate such screening by measuring the effect of dielectric wakefields driven by an electron bunch in an uncoated dielectric capillary where the plasma is confined [1]. We show that the plasma screens the space-charge field and therefore suppresses the dielectric wakefields when the distance between the bunch and the dielectric surface is much larger than the plasma skin depth. We also present recent experimental results from SPARC_LAB on guiding of electron bunches in a curved plasma-discharge capillary [2], and on focusing and acceleration in an all-plasma compact device [3]. We discuss the impact of these results on the design of EuPRAXIA@SPARC_LAB, a user-oriented free-electron laser based on plasma wakefield acceleration.

[1] L. Verra et al., submitted (2024)

[2] R. Pompili et al., accepted in Phys. Rev. Lett. (2024)

[3] R. Pompili et al., Phys. Rev. E 109, 055202 (2024)

Working group

invited speaker

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