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Quadrupole field instability in cylindrical dielectric wakefield accelerators

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Dielectric Wakefield Acceleration is a technology under active research, providing the potential to accelerate charged particle bunches with gradients much greater than conventional RF-based metallic cavities. The stability of driving bunches needs to be solved before practical applications are seen. Strong transverse fields are known to be excited in DWAs, with previous research focusing on mitigating single-beam breakup instability (BBU) induced when a beam propagates off-center due to orbit-jitter or misalignment. It is also known that quadrupole-like fields are excited in planar/slab DWA structures and research has been conducted on mitigating this effect. We present simulation results that demonstrate quadrupole-like fields are also excited in circular DLWs, induced by beam astigmatism. We have shown that this is an extra source of instability within circular DWA structures and calculate the size of the fields excited as a function of beam astigmatism.

Footnotes

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