

Abstract Submitted
for the DPP19 Meeting of
The American Physical Society

Using Dust Dynamics to Diagnose Evolving Plasma Conditions

LORIN MATTHEWS, DUSTIN SANFORD, KHANDAKER ASHRAFI, TRUPELL HYDE, Baylor University — Micron-sized dust grains have been successfully employed as non-perturbative probes to measure variations in plasma conditions on small spatial scales, such as those found in plasma sheaths. Within a sheath, ions are accelerated towards the charged boundary, and this ion flow creates a positively-charged spatial region downstream of the dust grain, called the ion wake. The ion wake in turn modifies the interaction potential between the charged grains and can contribute to the stability of the dust structures formed under specific plasma conditions. A multi-scale numerical model of the dust-plasma interactions is compared with experimental data which allows determination of quantities such as the charge on individual grains, the electric field within the region, the ion density, and the ion flow velocity. This work is supported by NASA grant 1571701, and NSF grants 1740203, 1707215.

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Date submitted: 03 Jul 2019

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