

MINIATURE 3D-PRINTED SUPER SENSOR: Multi-Langmuir Probe Device for CubeSat Ionospheric Plasma Diagnostics



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Why?

The ionosphere (part of the atmosphere stretching from 50-400 miles above Earth's surface) plays a huge role in global warming. **It is made entirely of plasma.**

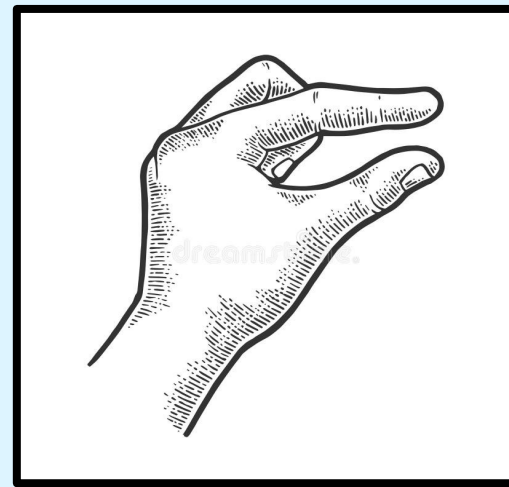
It is also very expensive to reach. Luckily, there are **CubeSats** (tiny satellites that make it cheap to reach the ionosphere).

What

Langmuir probes (LPs) are a **simple** and **versatile** type of plasma sensor.

They work by applying a voltage to an electrode and measuring the plasma particles (i.e., current) that come in.

Needs



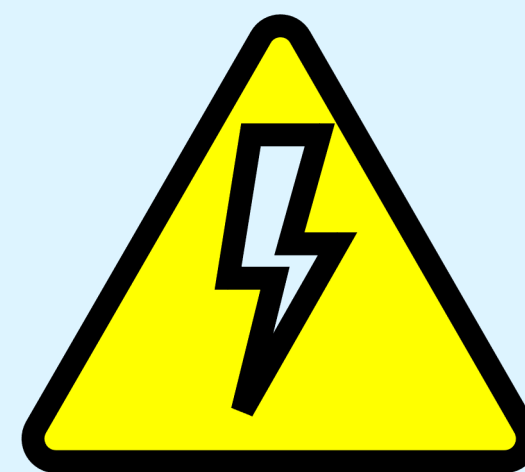
Miniature

So it can be launched cheaply



3D-Printed

To be compatible with in-space manufacturing



Low Power

To run off a CubeSat's solar panels

It works!

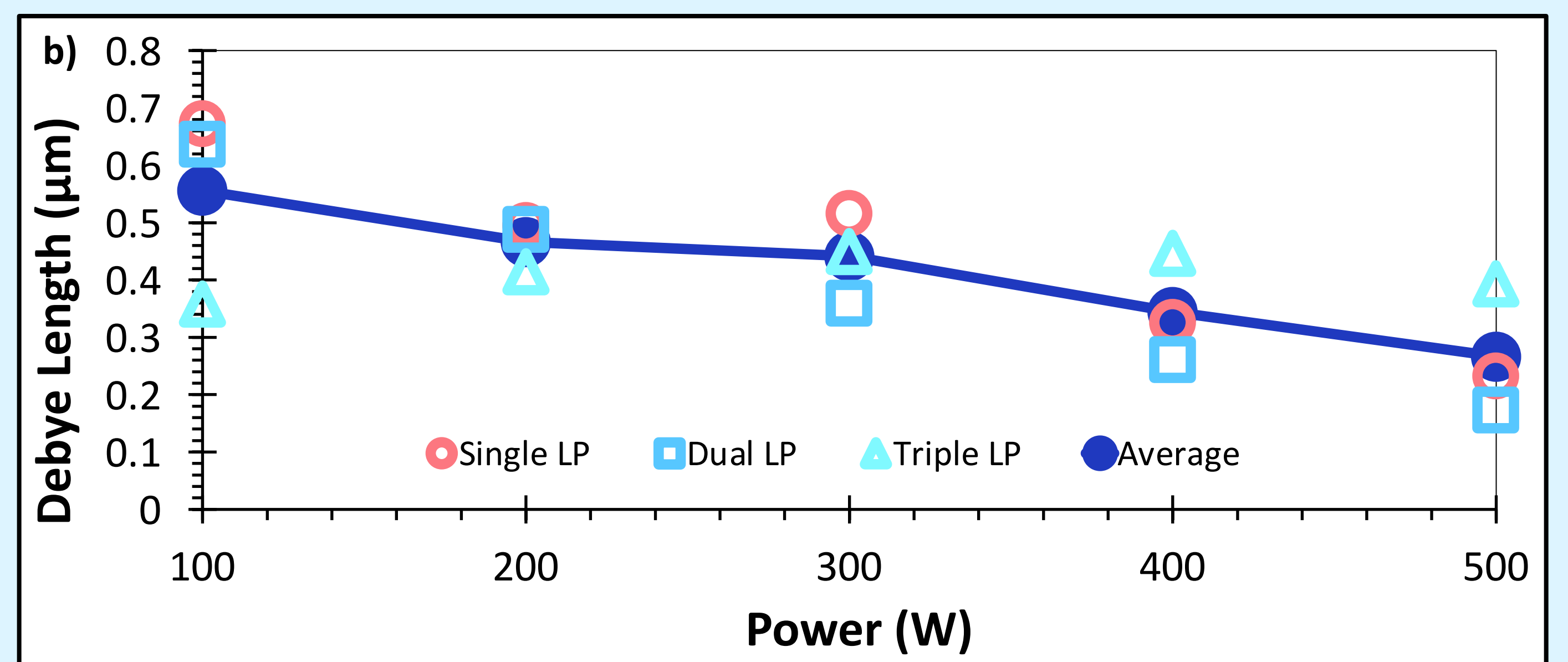
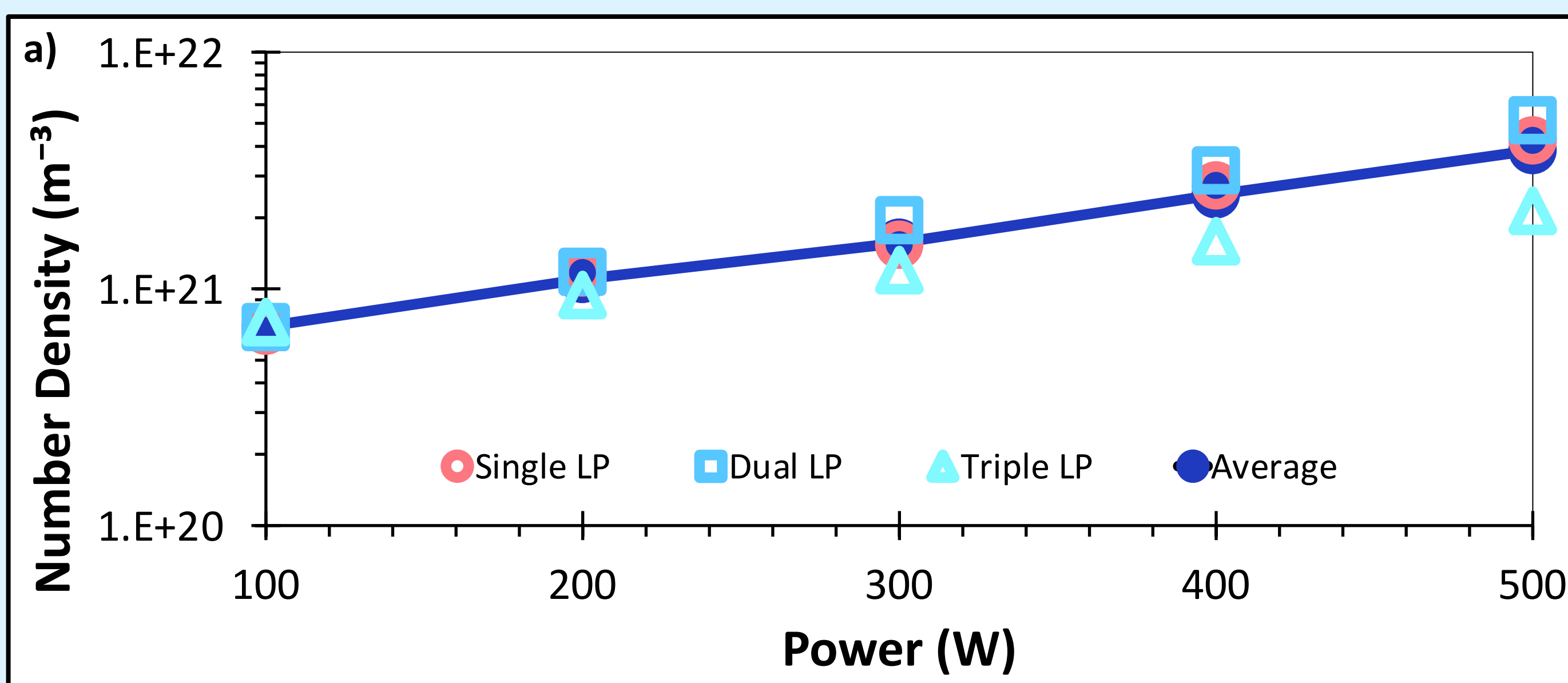


Figure 1: Time-averaged plasma parameters plotted against power for single, dual, and triple LPs, for a) number density, and b) Debye length.

Total Power Consumption: 0.78 W, Total Volume: 10 cm x 10 cm x 2.5 cm

We made a miniature, low-power, fully 3D-printed Langmuir probe device, which operates single, dual, and triple LPs simultaneously, and can characterize a wide range of plasmas (100 – 500 W).

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