### **19-6. Electrostatically Enhanced Microbe collection in the Troposphere and Stratosphere**

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The biggest challenge in aerobiology is the collection efficiency due to the microbe concentration in the atmosphere. The limited access to air samples has prevented systematic studies and some of the basic questions in the field of aerobiology remains open. The project goal was to develop a prototype system to demonstrate electrostatic precipitation for air microbe sampling.

The Electrostatics and Surface Physics Lab (ESPL) team conducted four experiments that included UV Exposure, Electrostatic precipitator (ESP) redesign, two-stage ESP Corona, and two-stage ESP Collection. The team successfully prototyped a working two-stage precipitator to demonstrate particulate capture in low pressure Earth environment. Tests performed and data recorded during this project show that the collection efficiency is over 98% for pressure ranging one of Earth’s standard atmosphere to half of Earth’s standard atmosphere. Even as the condition approaches the Paschen minimum, the geometry of the ESP can adapt to ensure particle collection.

Although the KSC team set out to design the precipitator to be user friendly, the team quickly realized some of the user-friendly designs were incapable of particle collection. The wire-plate configuration has easy to remove setup but did not have a strong electric field. Additionally, for the co-axial design it was difficulty to install thin electrodes inside the small cylindrical volume while wearing gloves. The team also realizes the 3-D printed Polylactic acid (PLA) connections are insufficient in providing an electrically insulated connection. The pores and groves between each printed layers trapped air molecules that ionized at higher voltage potential. This created an unstable electric field across the charging region that disrupted particle charging. Lastly, the prototype hardware was unable to be vacuum-sealed due to the 3-D printed connector. Hence, tests are limited inside a vacuum bell jar. This created a longer path between the fine particle analyzers (FPA) to the test section and trapped particles in the feedline that resulted in a difference between upstream and downstream measurements. For future work, the KSC team would like to continue working with the ARC team to continue the microbe ESP development. The KSC team are looking for flight opportunities with additional development funding to fix the electrical and vacuum insulation issue to improve the overall setup.