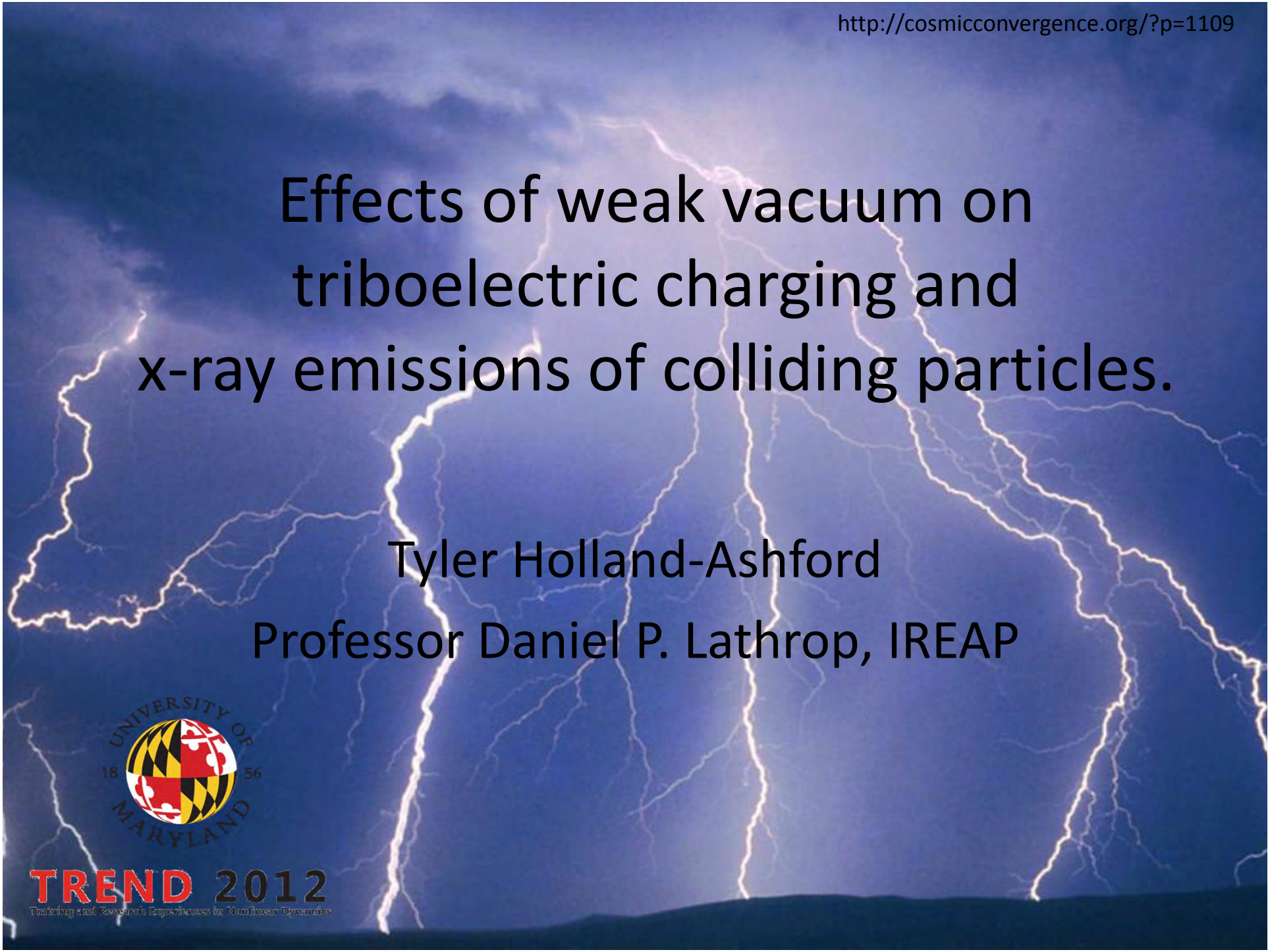


Effects of weak vacuum on triboelectric charging and x-ray emissions of colliding particles.

Tyler Holland-Ashford

Professor Daniel P. Lathrop, IREAP

UNIVERSITY OF MARYLAND 18 56

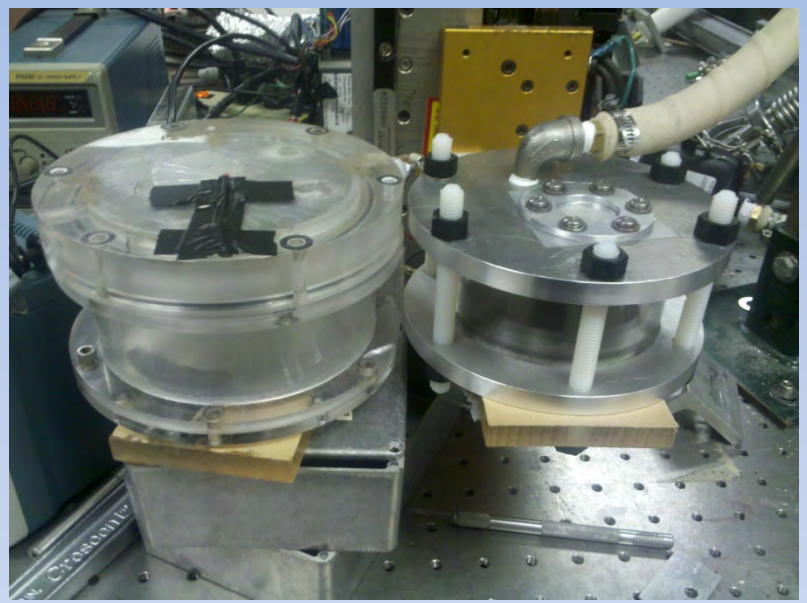
TREND 2012

Training and Research Experiences in Nonlinear Dynamics

Background

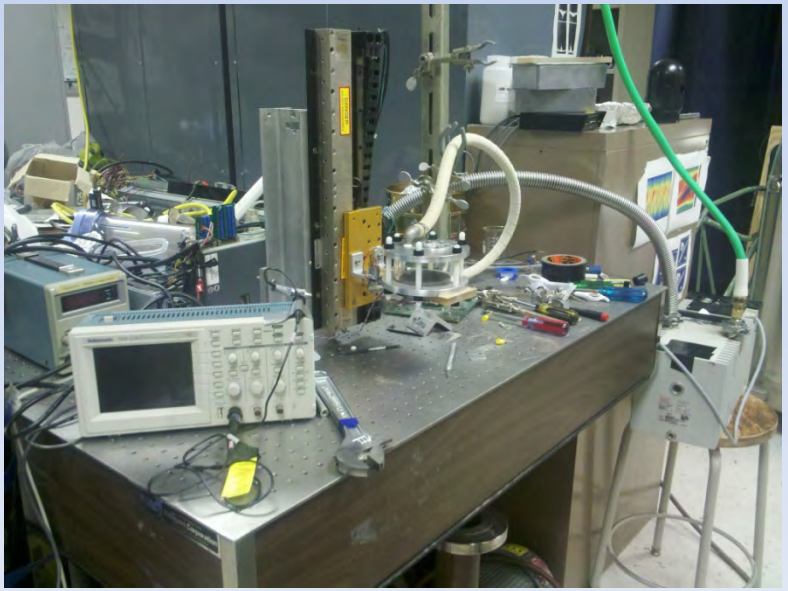
- The triboelectric effect: charging due to collisions
- Believed to be the reason for lightning in thunder and sand storms
- Yet poorly understood
- Release x-rays when occur in a vacuum.

Apparatus



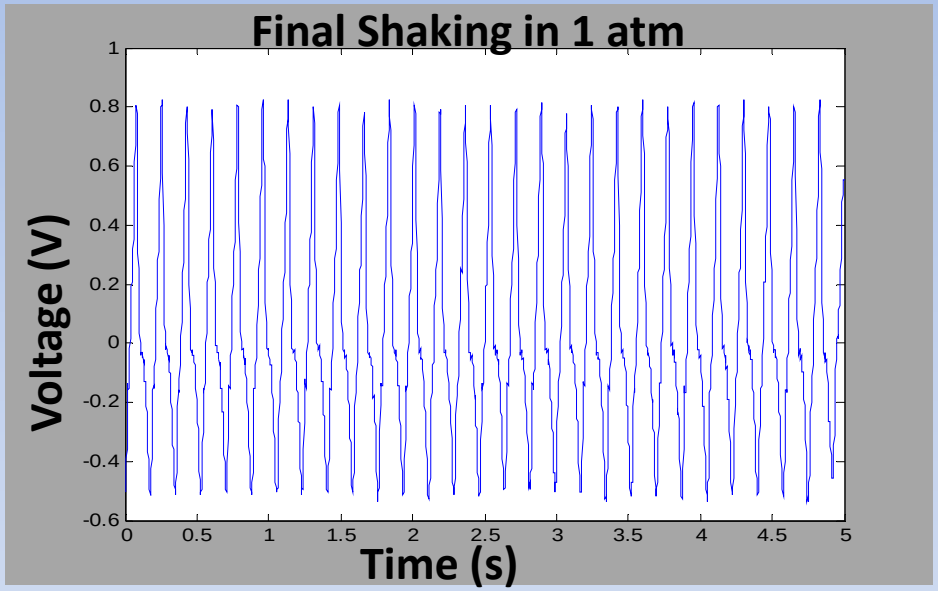
(Far Left): The previous incarnation made of acrylic with thin aluminum plates
(Left) the newer model with a glass cylinder and thick aluminum plates.

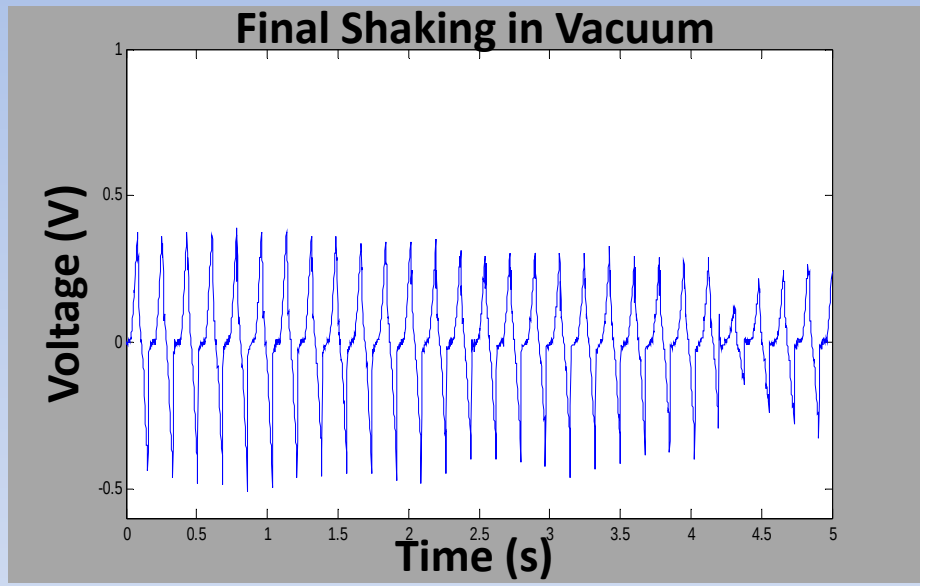
(Right): The whole system.
- Oscilliscope
- Shaker
- Cell
- Vacuum tubing
- Filter (hidden)
- Pump



Results

Shaking the cell in atmospheric pressure vs in 20 milli-torr vacuum





- Loss of gaseous particles might have caused the lower voltage
- Pressure has more of an effect on voltage than humidity does
- Fluctuations in voltage for vacuum system are not understood

X-Rays and Future Studies

- Calibrated for Cadmium-109, 88keV X-rays
- Found no significant difference in background rate and rate when shaking
- Future Work
  - Test for lower energy x-rays
  - Determine if there is a difference in charging when going from atmospheric pressure to vacuum and the opposite
  - Determine what the relation is between level of vacuum and voltage

Acknowedgements

- I would like to thank
- Professor Daniel Lathrop and Julia Salevan for the idea and support for the project
- Don Martin, Nolan Ballew, and Tim Koeth for guidance and materials;
- David Miechle and Hansen Nordsiek for guidance
- Zack Lasner for spending months figuring out how to use the shaker