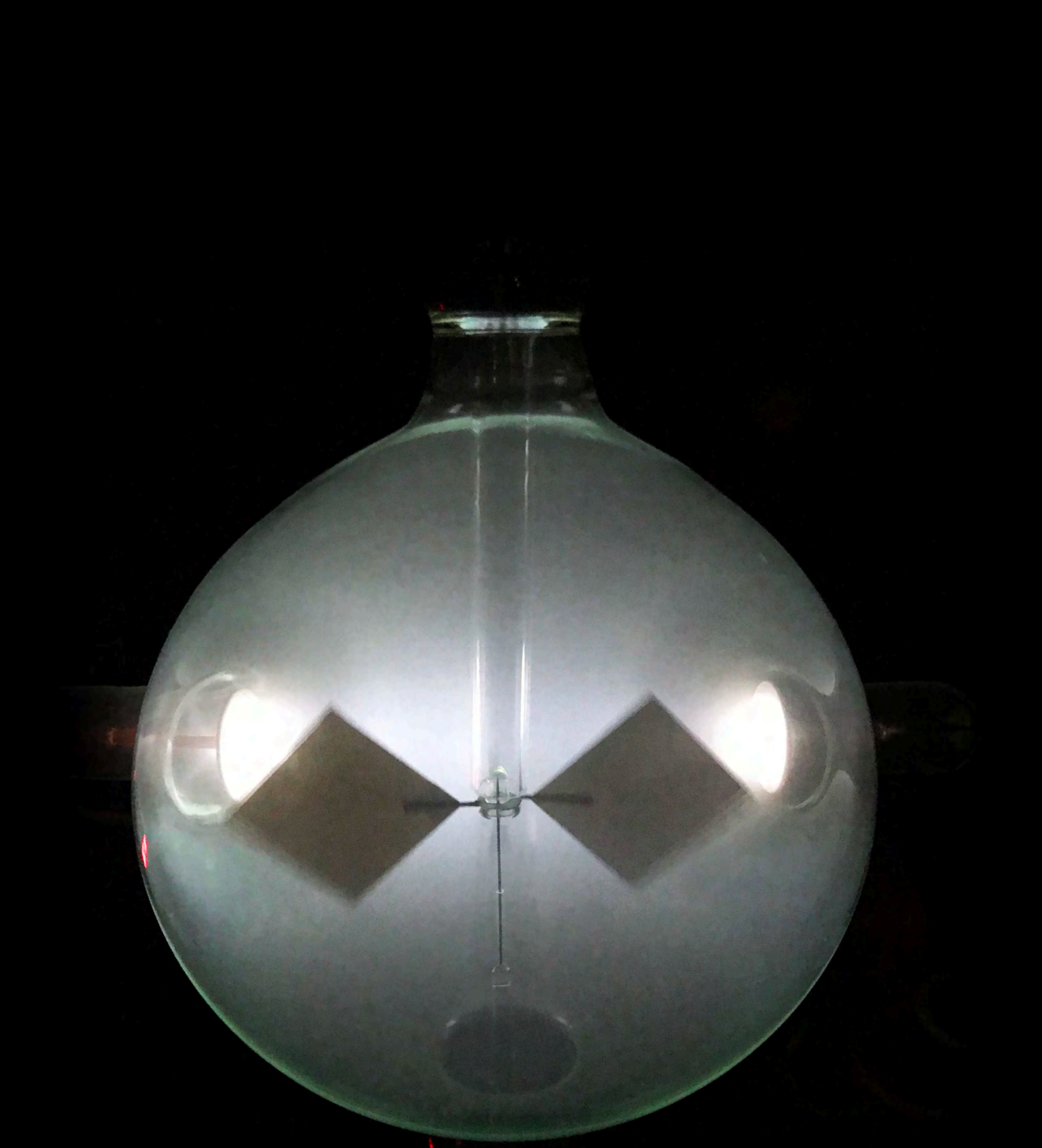
Electrical discharges in a vacuum: A selection of Crookes, Geissler, Mercury Vapour, and X-Ray Tubes.

Jeff Behary 2019

Crookes Tube with Phosphorescent Minerals: Positive electrode on the left

Crookes Tube with Phosphorescent Minerals: Positive electrode on the right

Crookes Railway Tube: Demonstrates that cathode rays can impart motion to objects



Crookes Radiometer: Demonstrates that cathode rays can impart motion in a vacuum

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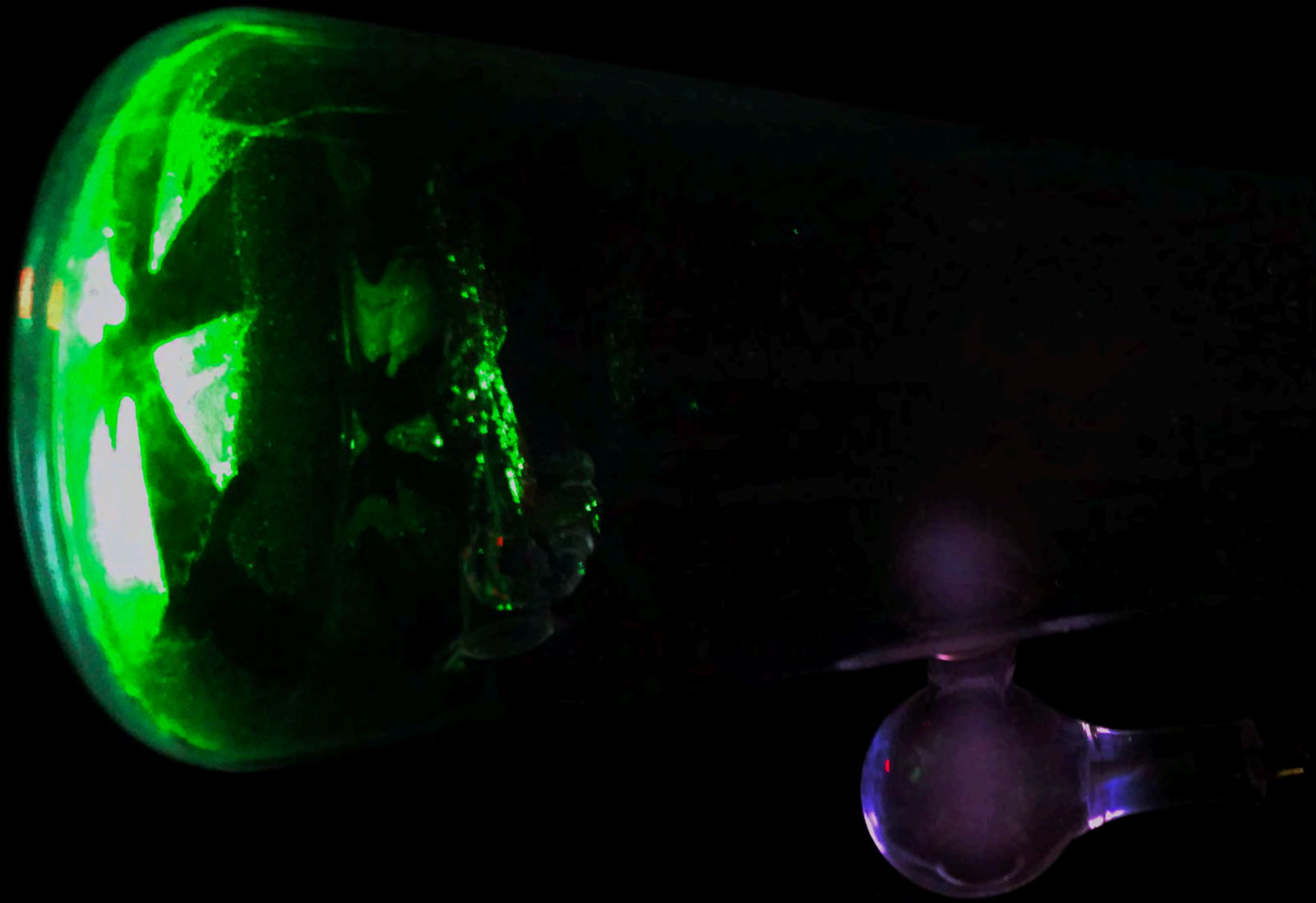
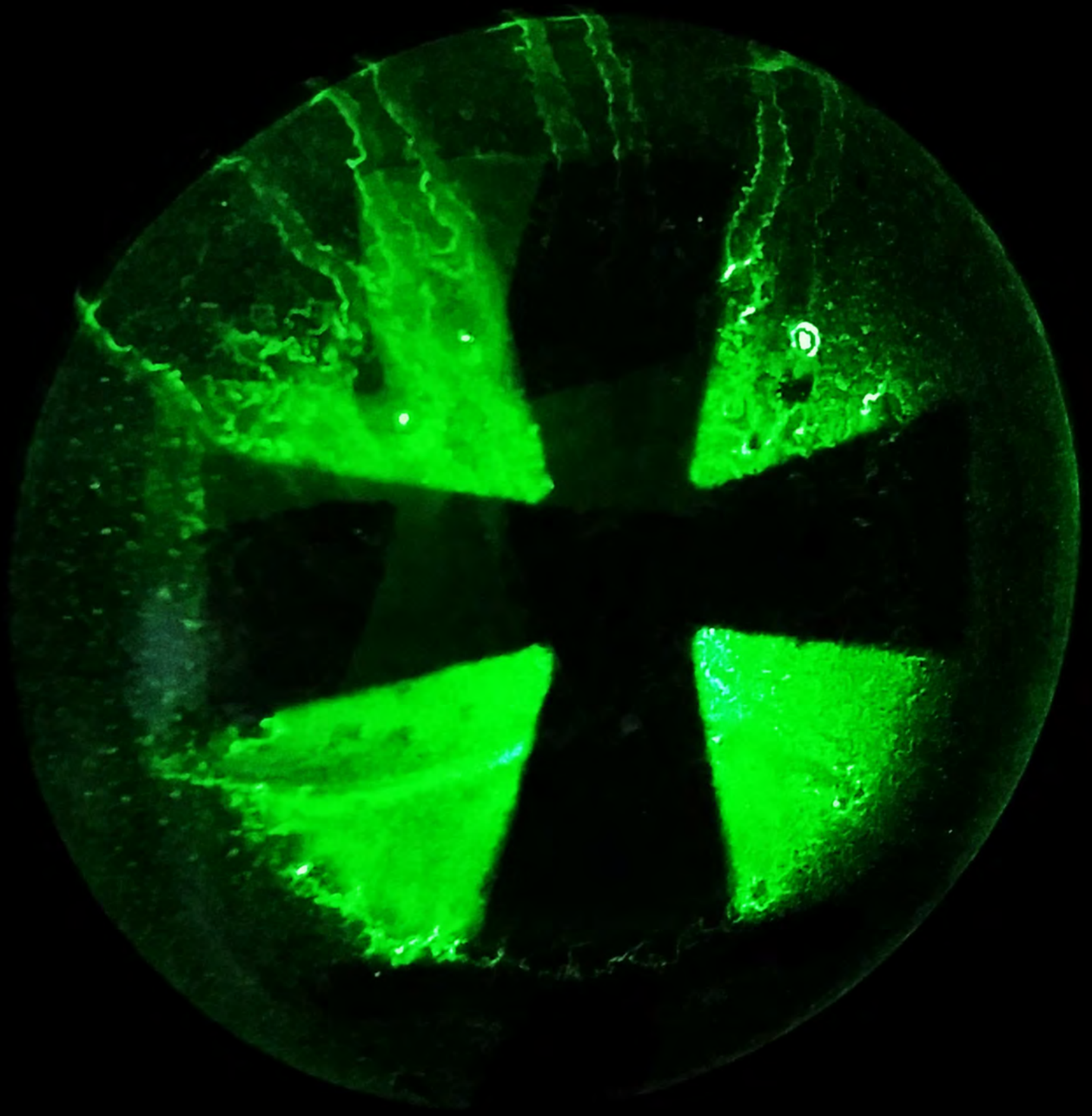
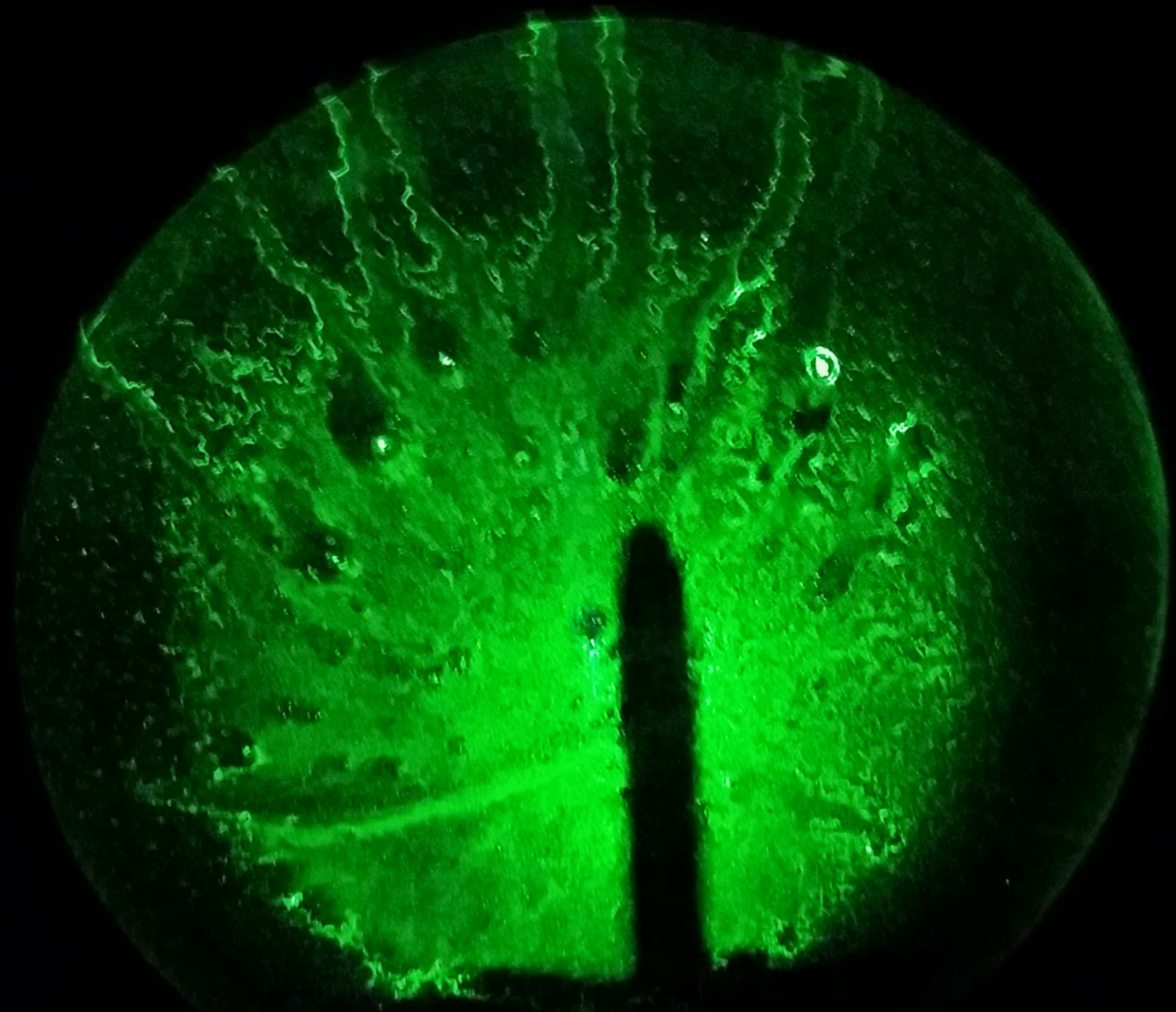


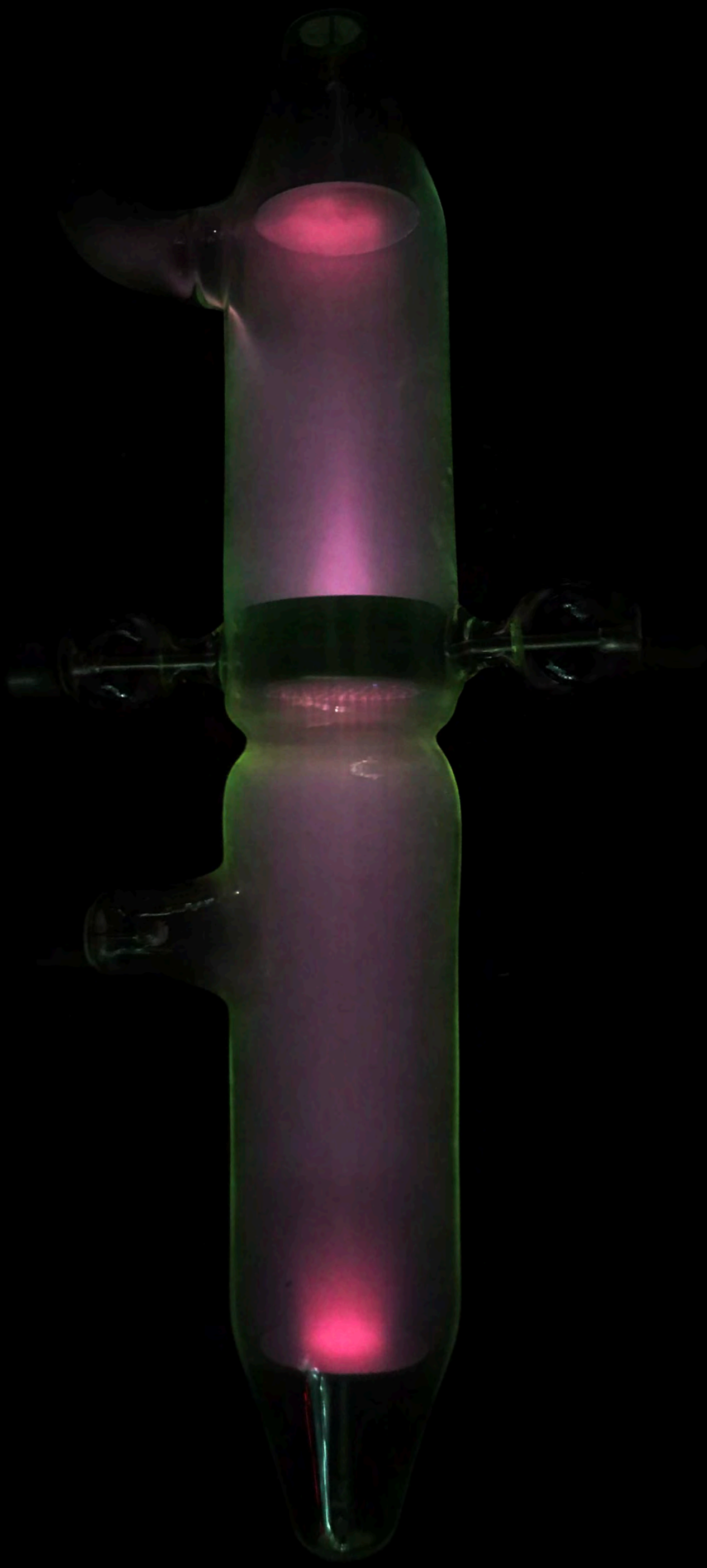
Crookes Maltese Cross Tube: Demonstrates that cathode rays travel in straight lines. The cross is mounted to a hinge so that it has the option of blocking the rays.



Crookes Maltese Cross Tube: Demonstrates stress of objects in the path of cathode rays. When the cross is lowered its shadow remains for a short while.



Crookes Maltese Cross Tube: Afterward its shadow can not be seen as the stress in the glass is relieved.

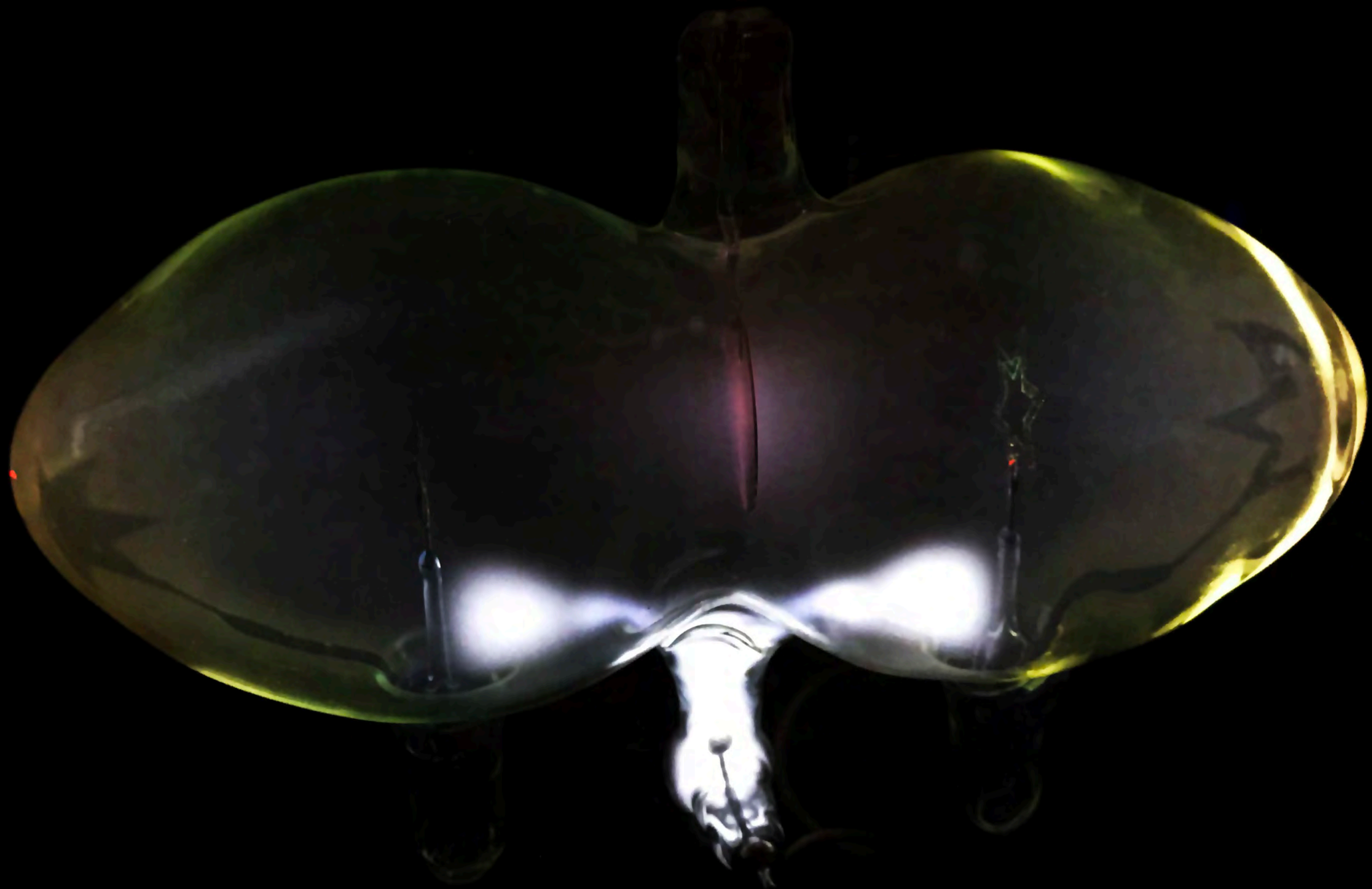


Canal Rays or Kanalstrahlen: An invention of Goldstein demonstrating heavier "anode rays"

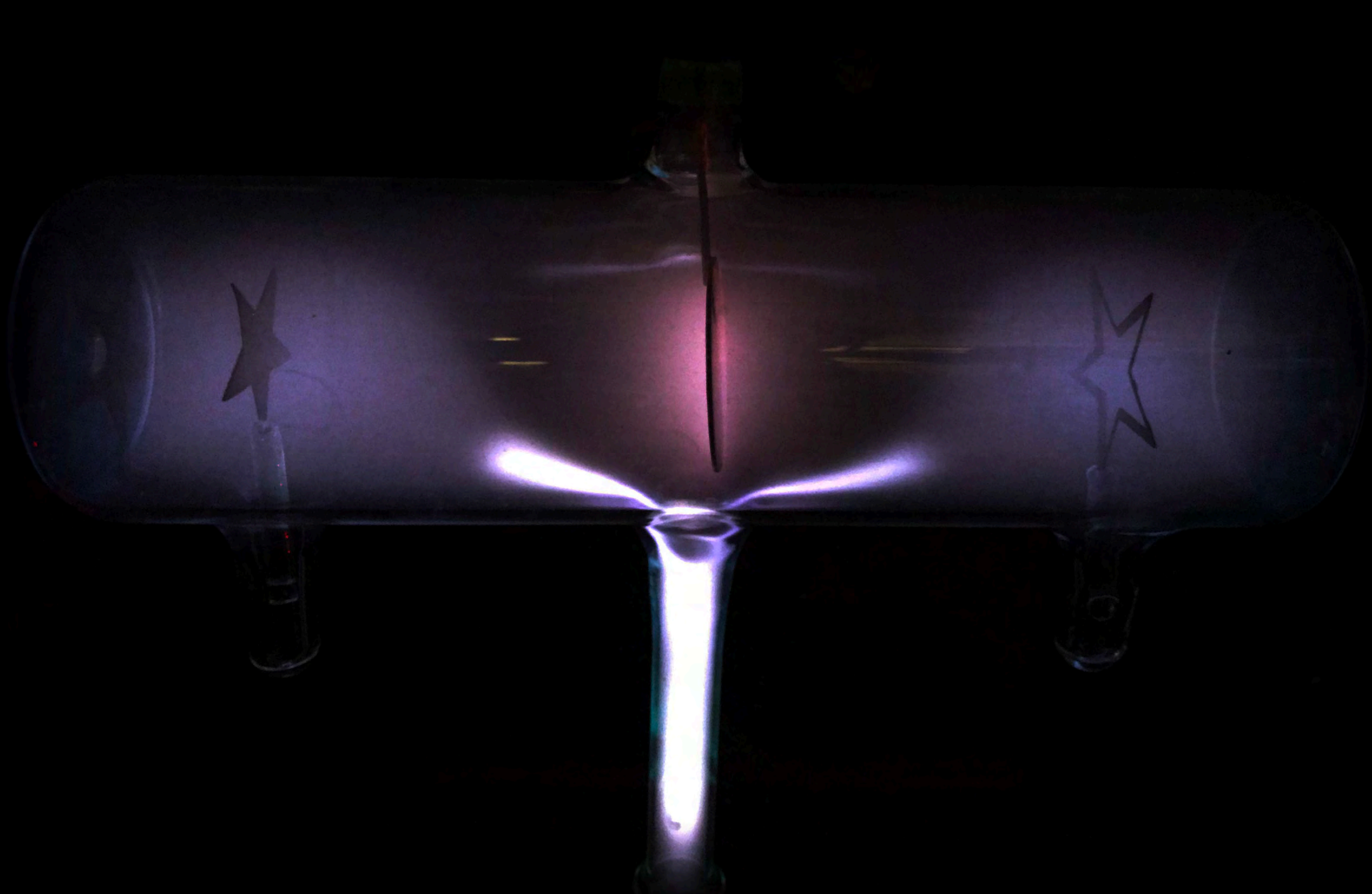
Anode Rays accelerate positive ions in the tube combining them in clusters that become attracted to the cathode.

Canal Rays or Kanalstrahlen: Ions are accelerated at speeds high enough to cause fluorescence in the tube as the different molecules change energy states.

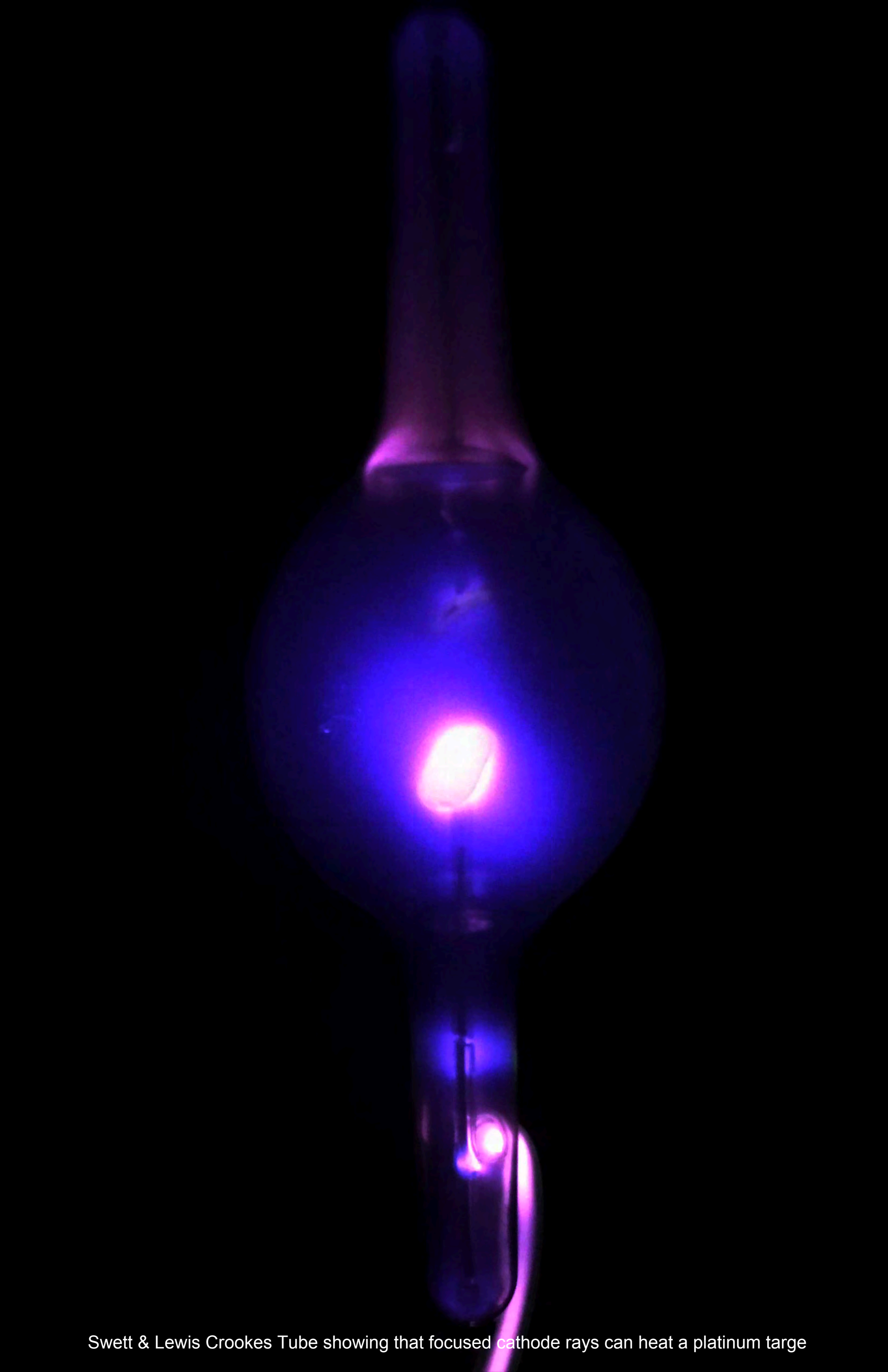
Crookes Tube with man inside: Novelty tube sold to the wealthy



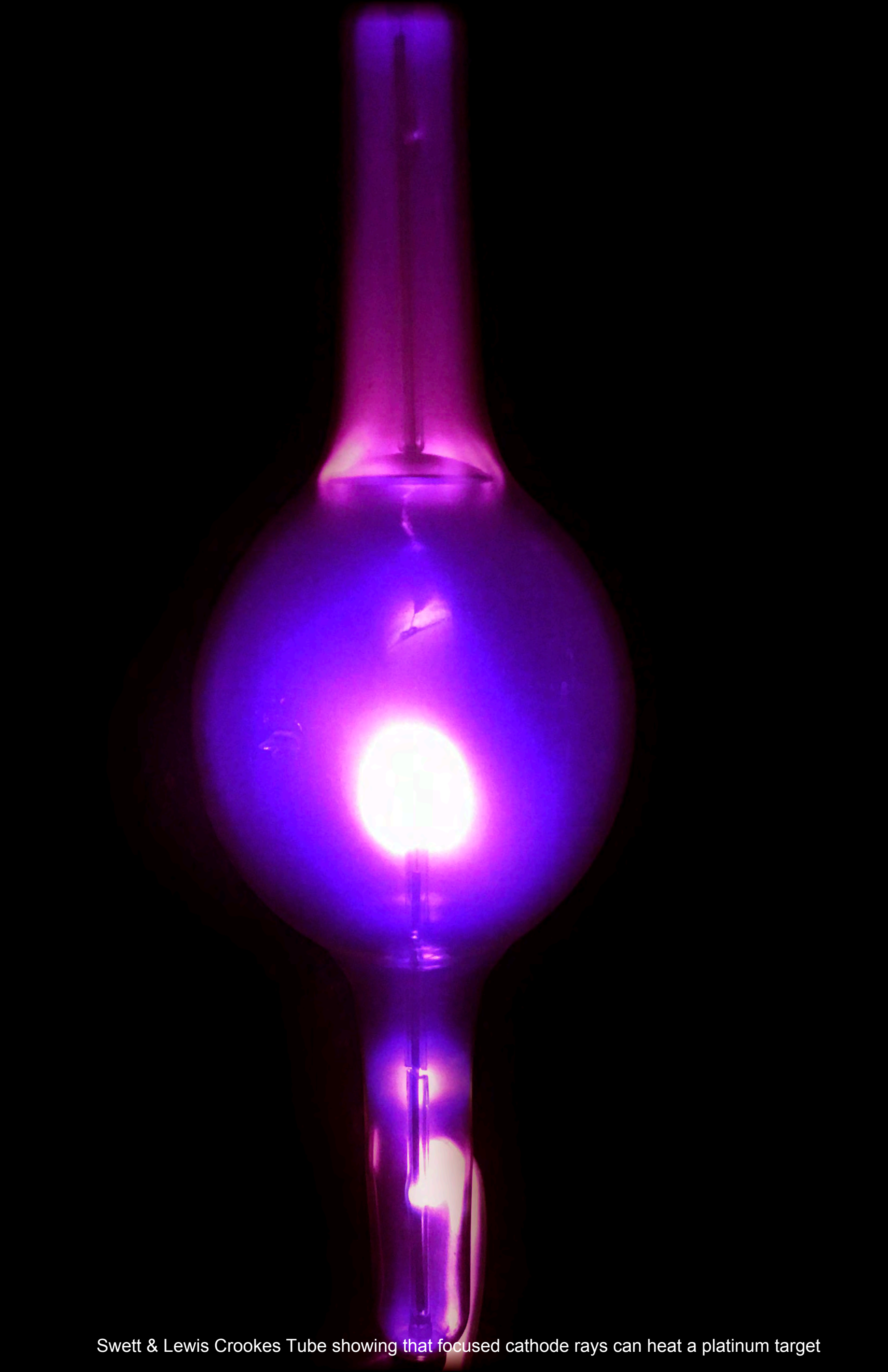
Puluj Tube: Cathode Ray tube invented by Ukraine physicist who pioneered tubes leading to the discovery of the X-Ray



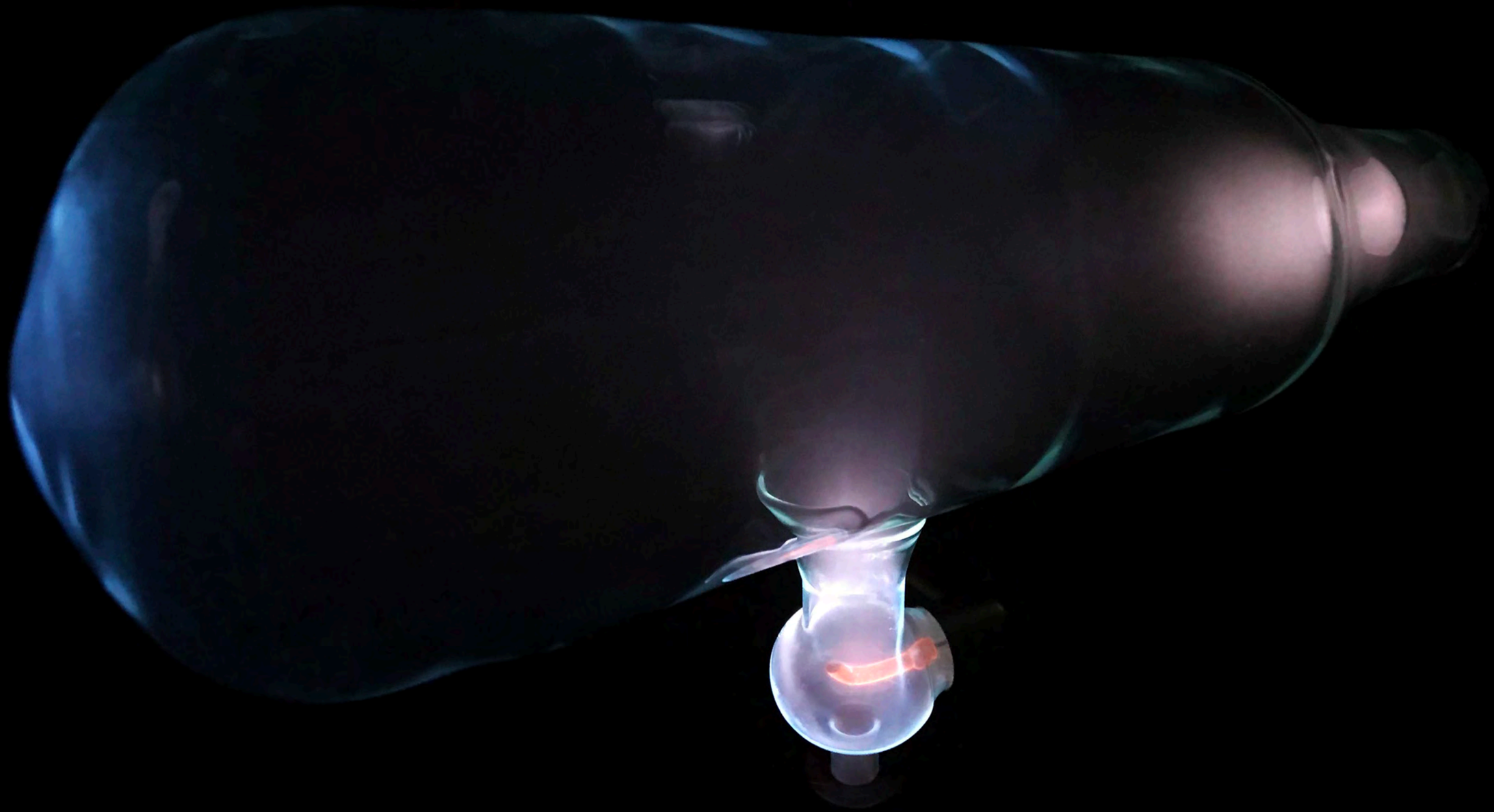
Puluj Tube: Cathode Ray tube invented by Ukraine physicist who pioneered tubes leading to the discovery of the X-Ray:
While the vacuum is low in this tube, a shadow of the left star can still be seen on the glass showing cathode rays present.



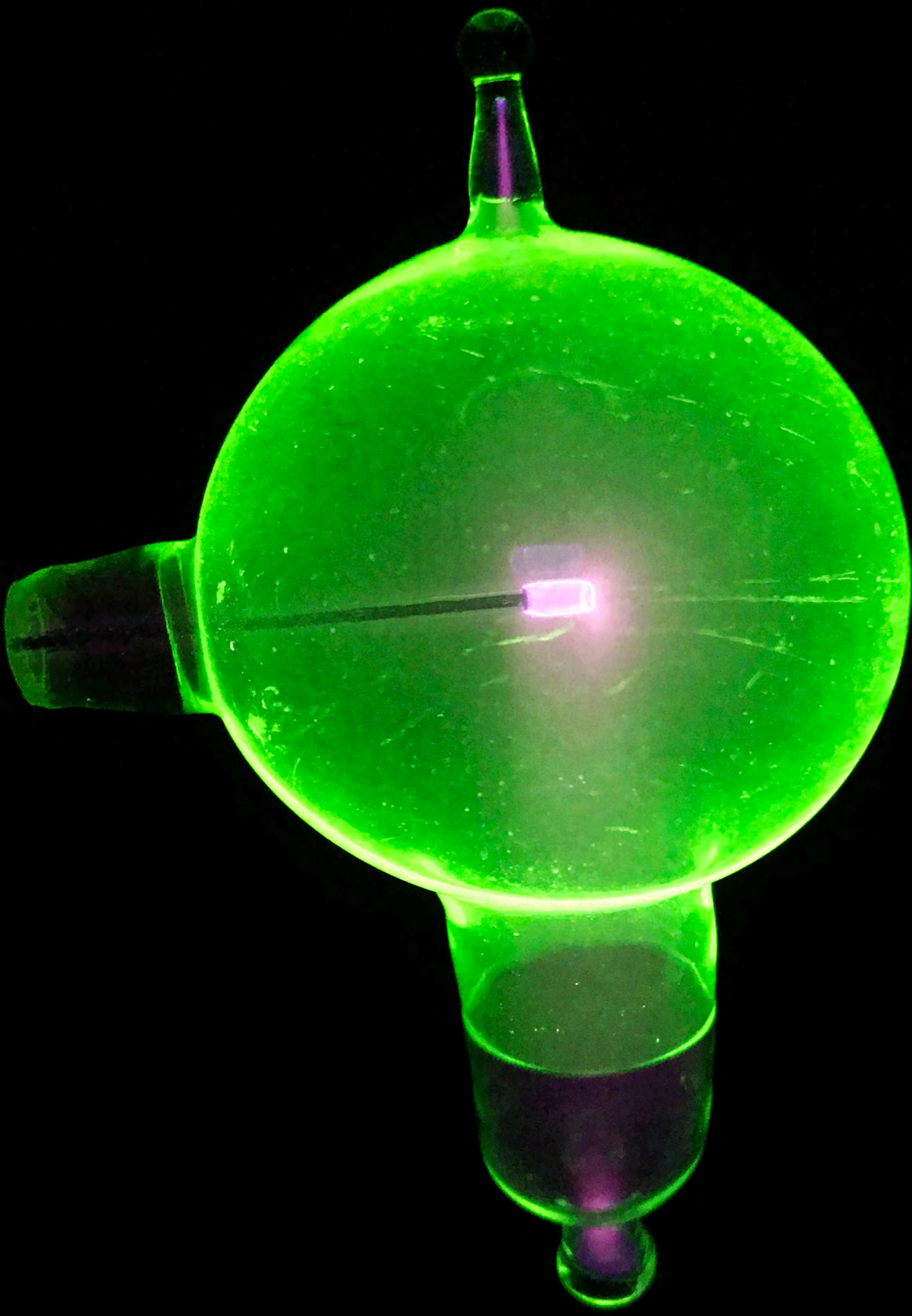
Swett & Lewis Crookes Tube showing that focused cathode rays can heat a platinum targe



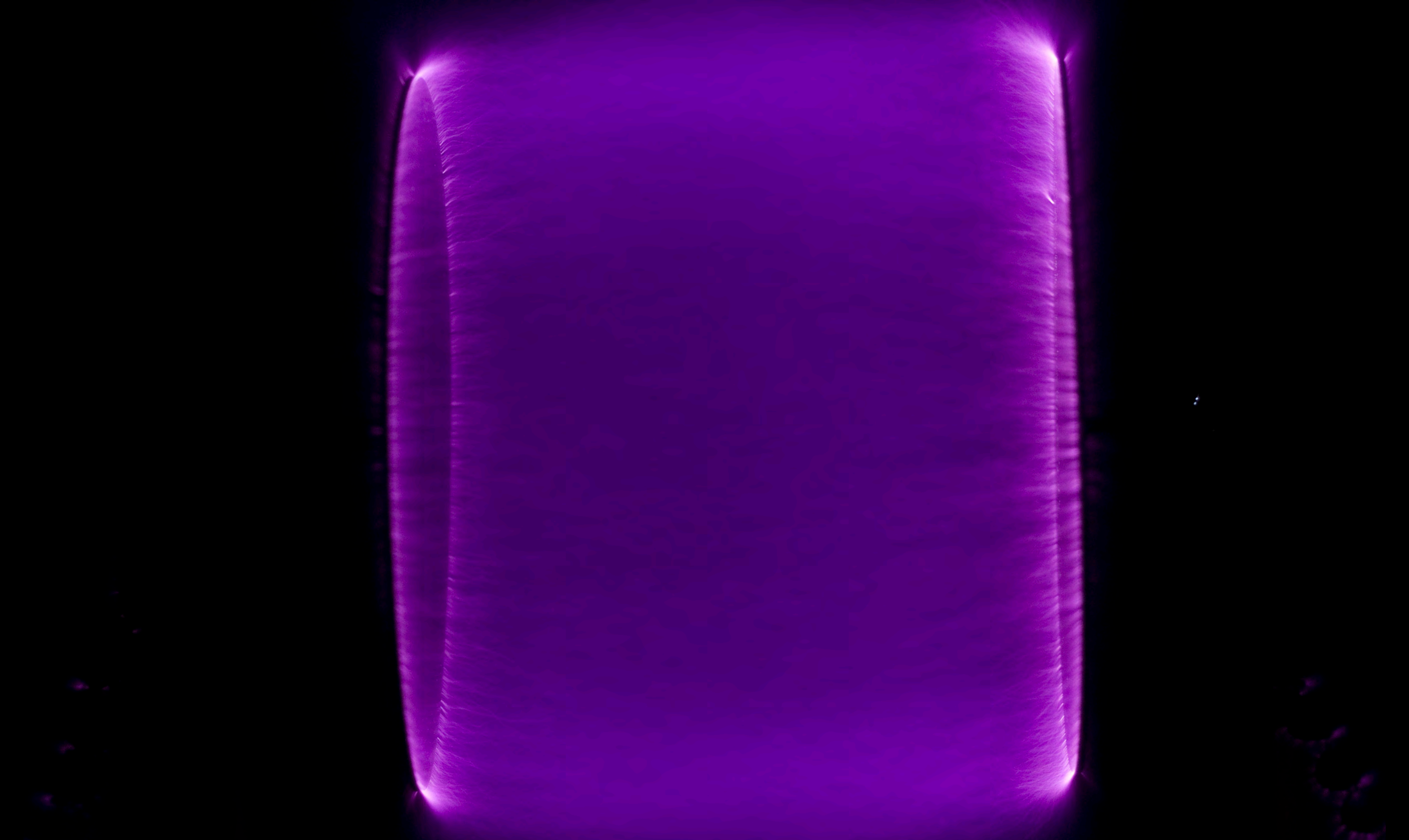
Swett & Lewis Crookes Tube showing that focused cathode rays can heat a platinum target



Replica of the original Hittorf Tube Professor Röntgen used in his accidental discovery of the X-Ray while studying ultraviolet radiations



Nikola Tesla Single Wire Phosphorescent Button Lamp

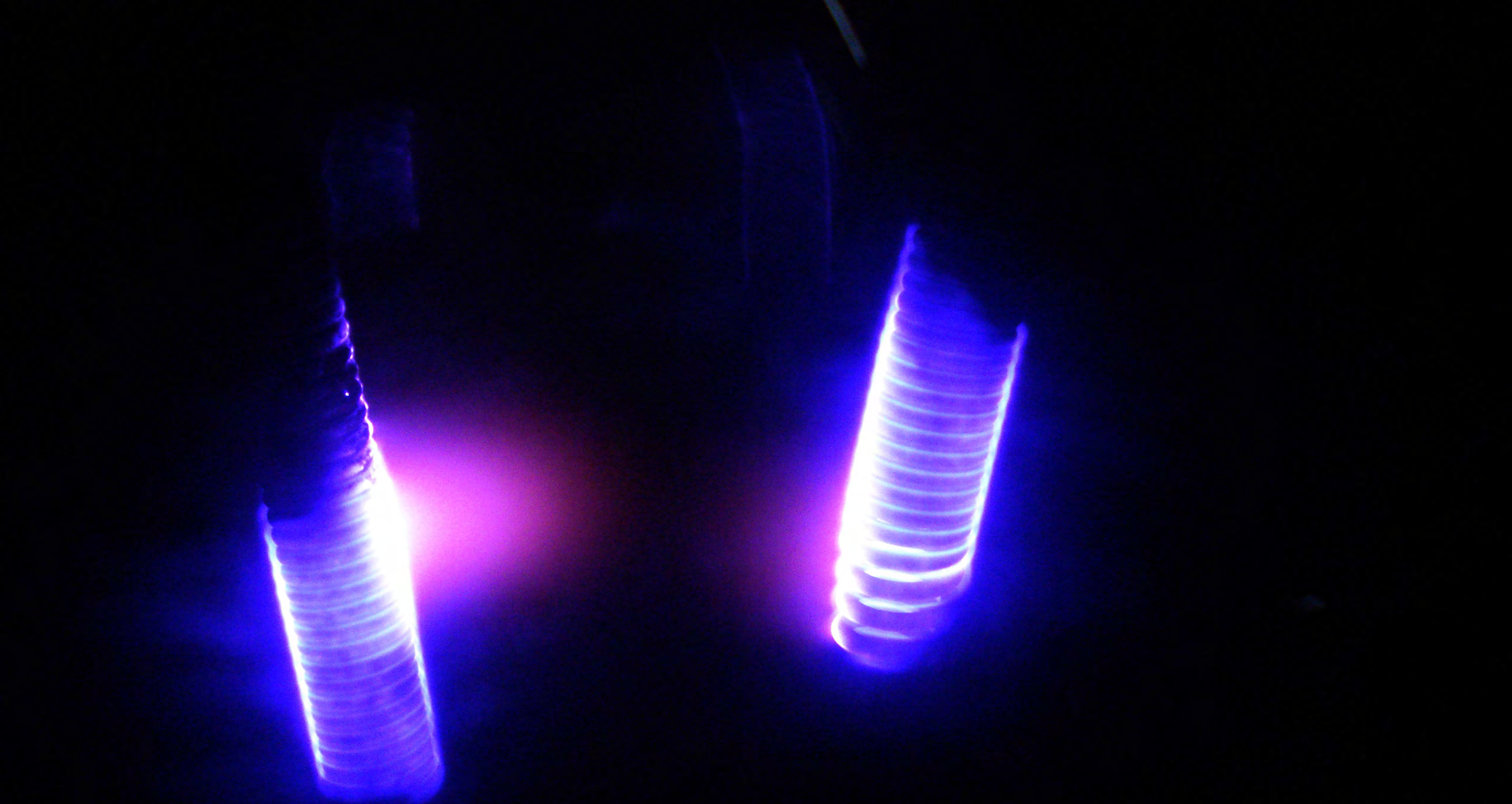


Open-air system of lighting devised by Nikola Tesla where metal plates charged to a high voltage and high frequency ionize the ambient air in room. While beautiful to witness this process quickly fills the room with toxic ozone and nitric compounds.

Nikola Tesla Wireless Energy Electrodeless Lamp made with neon gas.

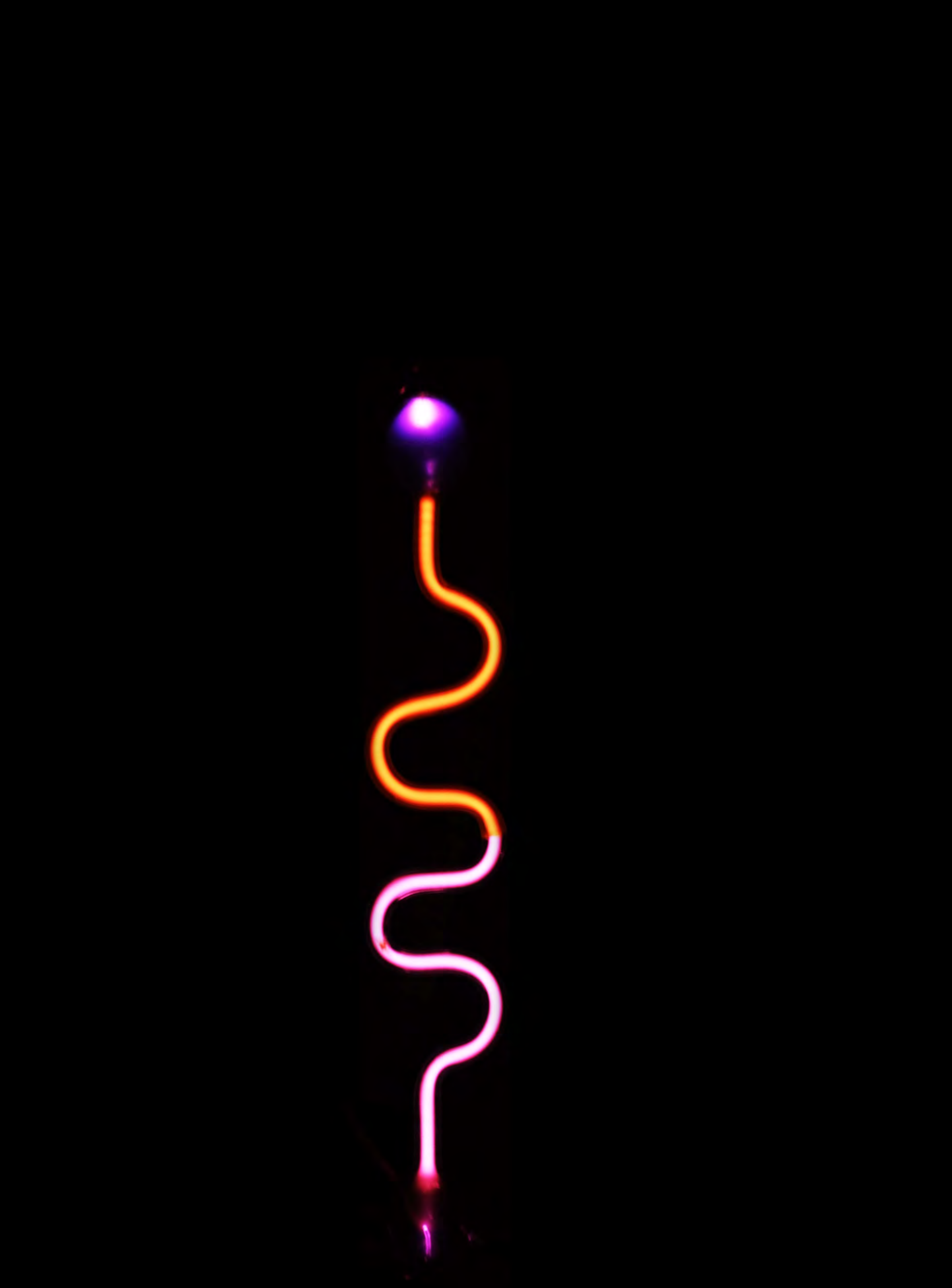
Nikola Tesla Wireless Energy Electrodeless Lamp made with argon gas

Ebert Lamp: Phosphorescent Lamp using external electrodes powered with high frequency currents



Electricity in a bell jar: Light in a partial vacuum, 1/10,000th of an atmosphere

Electricity in a bell jar: Light in a partial vacuum, 1/100,000th of an atmosphere

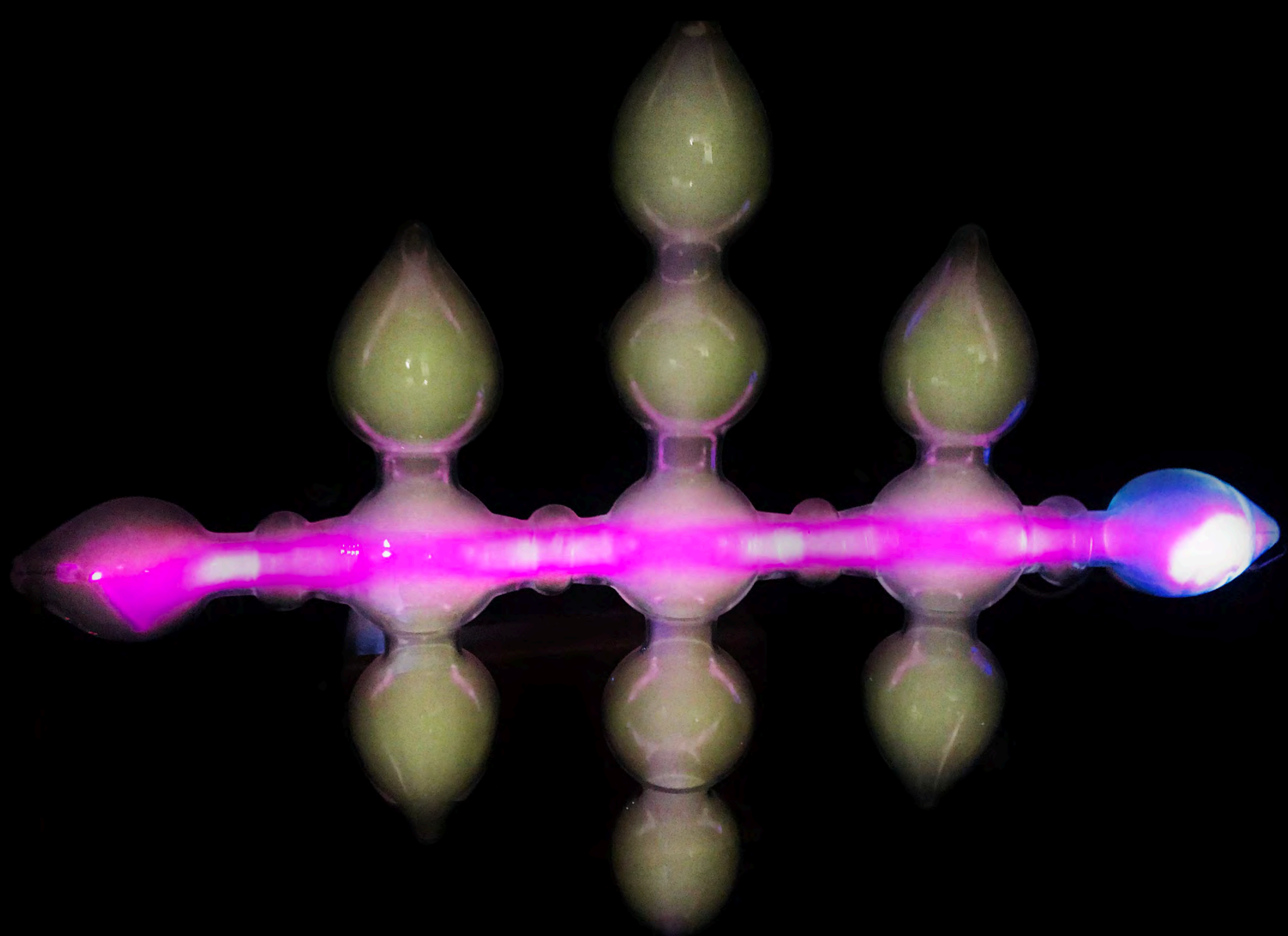


Geissler Tube: Early electric lamp using residual air in a vacuum. Made with colored glass fused to soda lime glass.

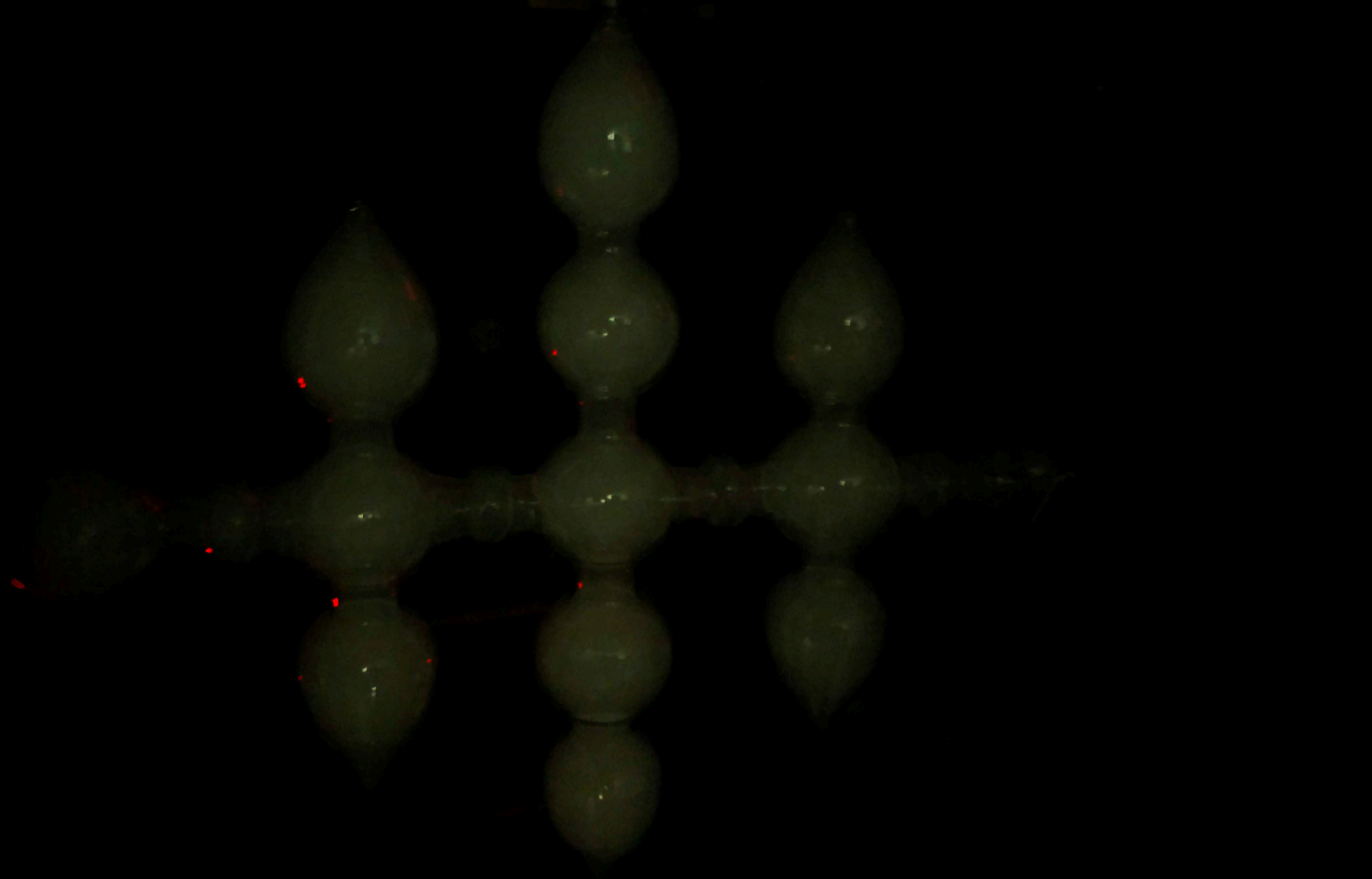
Geissler Tube: Early electric lamp using residual air in a vacuum. Made with uranium oxide glass fused to soda lime glass.

Electrodeless Geissler Tube made by Jeff Behary to demonstrate Tesla system of lighting.
Made with uranium oxide glass and borosilicate glass.

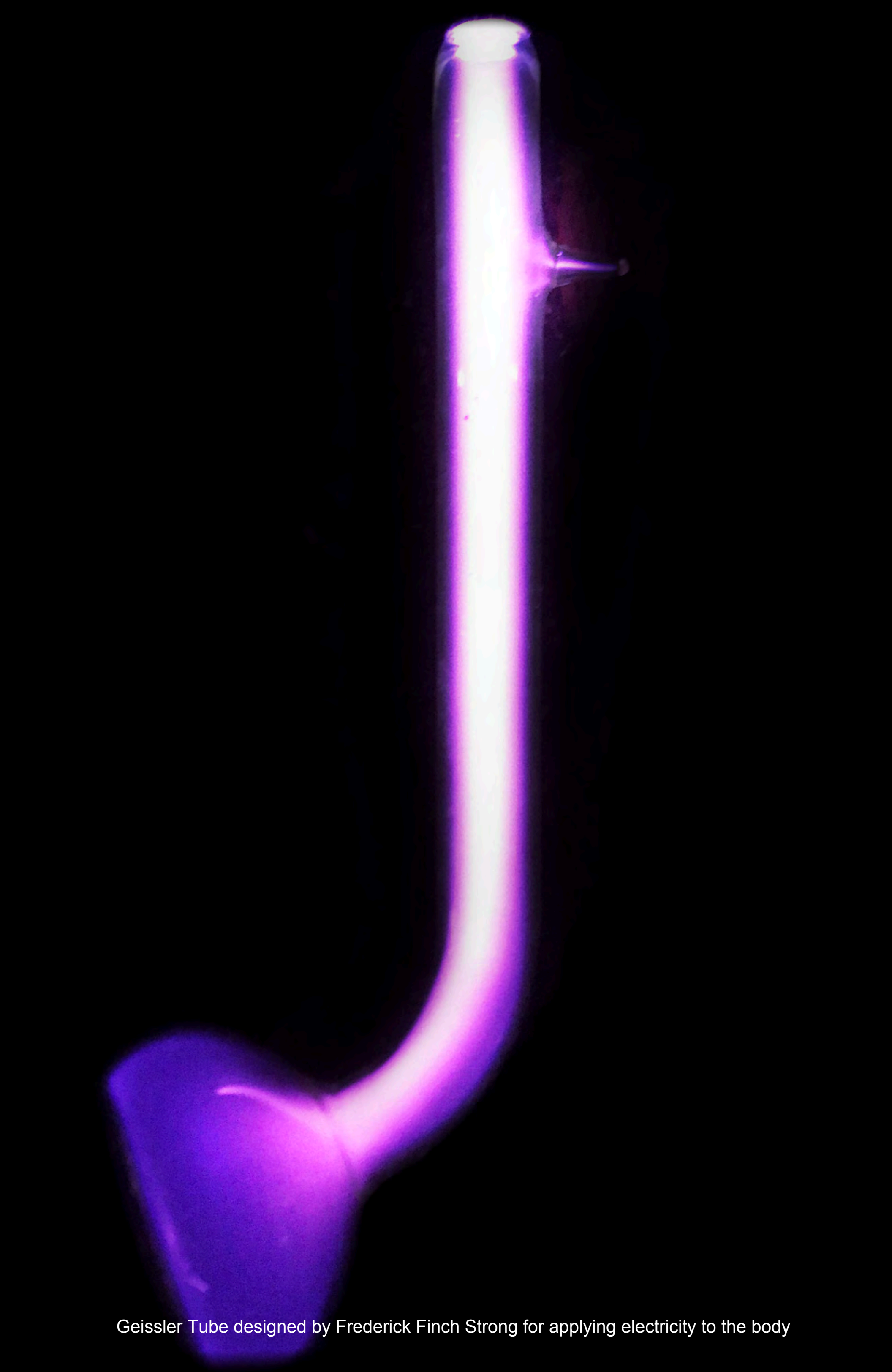
Electrodeless Geissler Tube made by Jeff Behary to demonstrate Tesla system of lighting.
Residual air in a partial vacuum positioned in the nearby electrical field of a Tesla Coil.



Persistence of Nitrogen Geissler Tube: Demonstrates the afterglow of nitrogen gas after power to the tube has been removed



Persistence of Nitrogen Geissler Tube: Demonstrates the afterglow of nitrogen gas after power to the tube has been removed

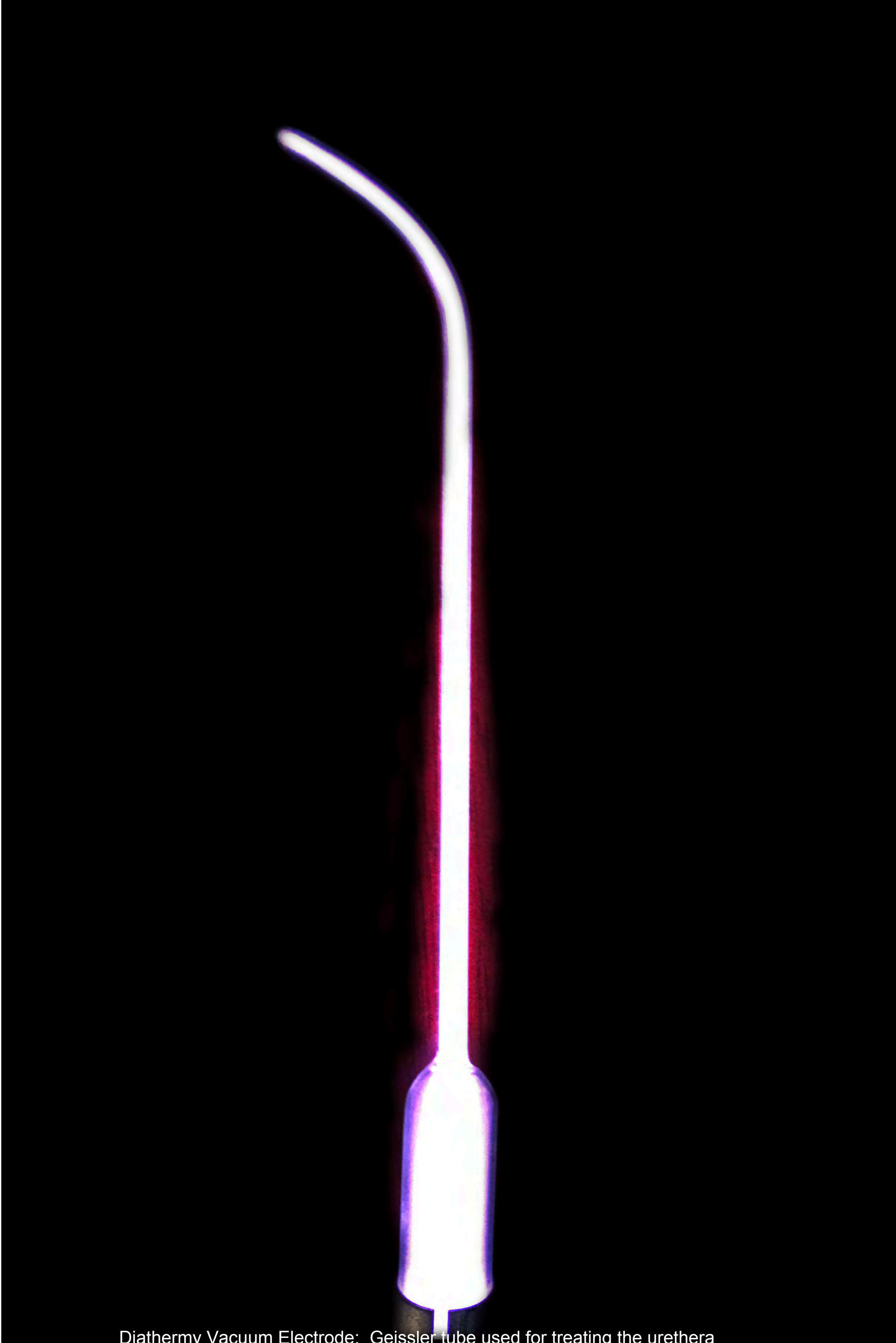


Geissler Tube designed by Frederick Finch Strong for applying electricity to the body

Electrotherapy using Frederick Finch Strong's Electrode Handle

Condenser Electrode: Geissler Tube invented by Frederick Finch Strong to apply Tesla currents to the body

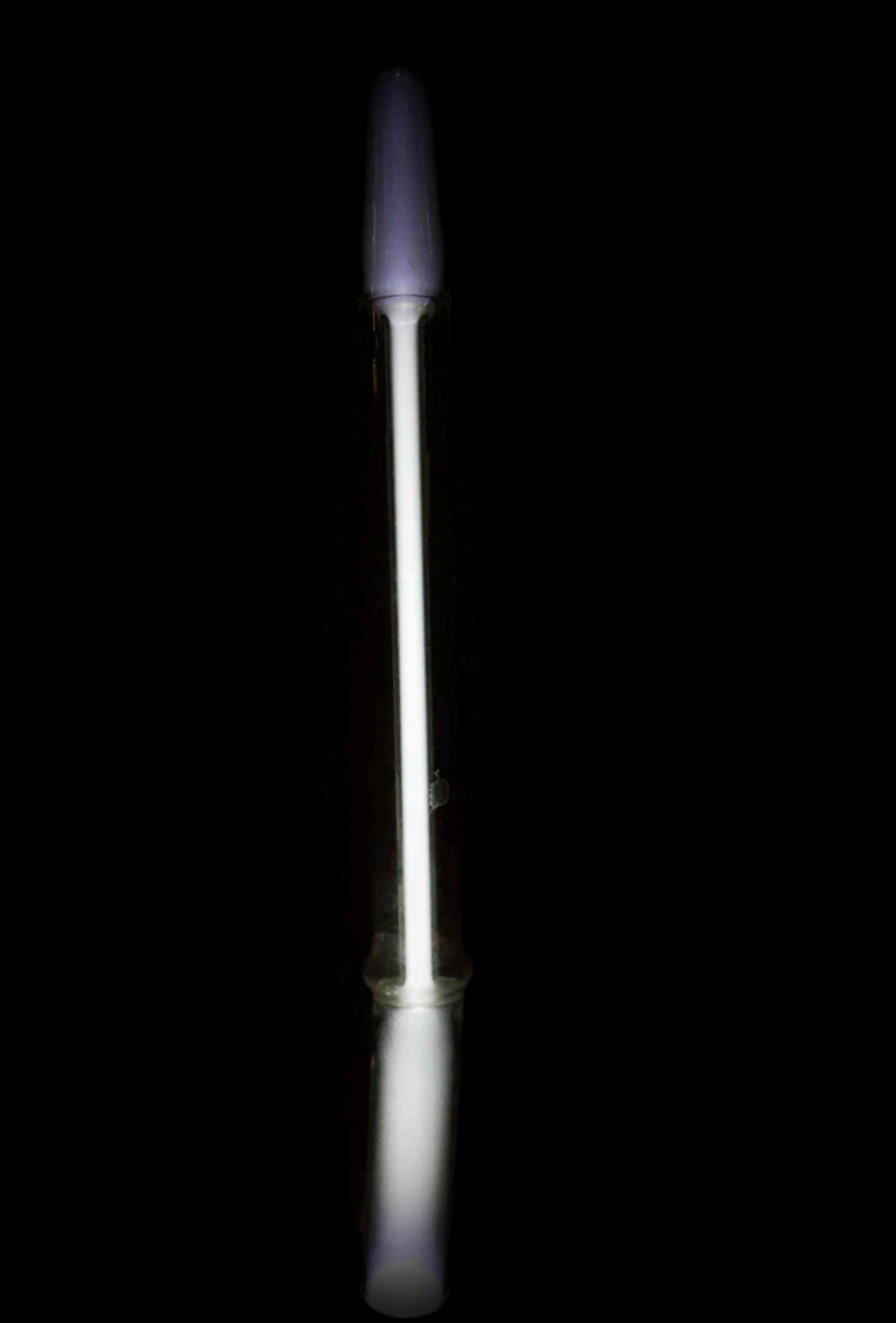
Diathermy Vacuum Electrode: Geissler tube used for treating the vagina



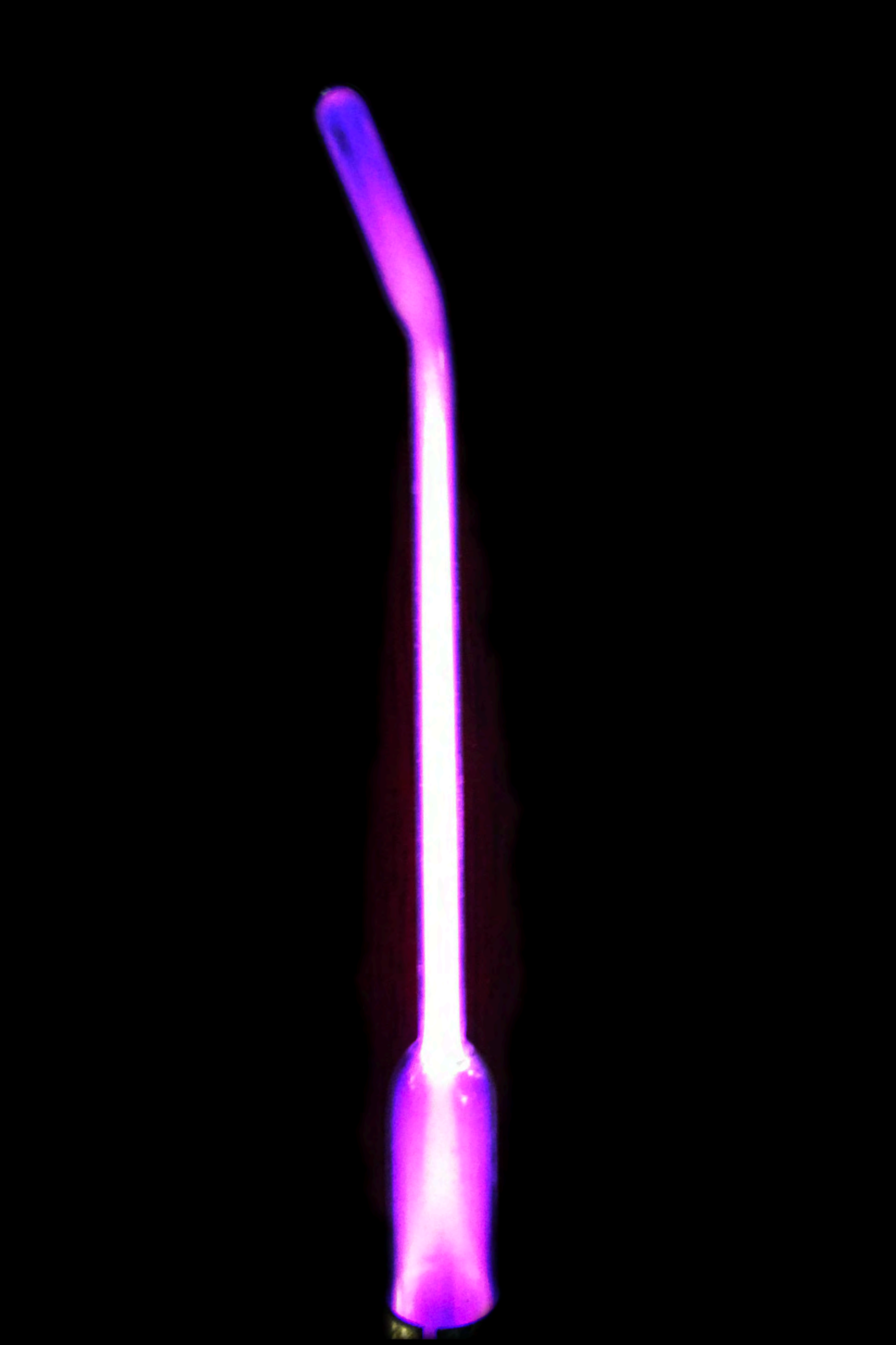
Diathermy Vacuum Electrode: Geissler tube used for treating the urethera

Diathermy Vacuum Electrode: Geissler tube used for treating the surface of the skin

Diathermy Glass Vacuum Electrode: Geissler tube used for treating the rectum



Diathermy Glass Vacuum Electrode: Geissler tube used for treating the prostate



Diathermy Glass Vacuum Electrode: Geissler tube used for treating the nasal passages

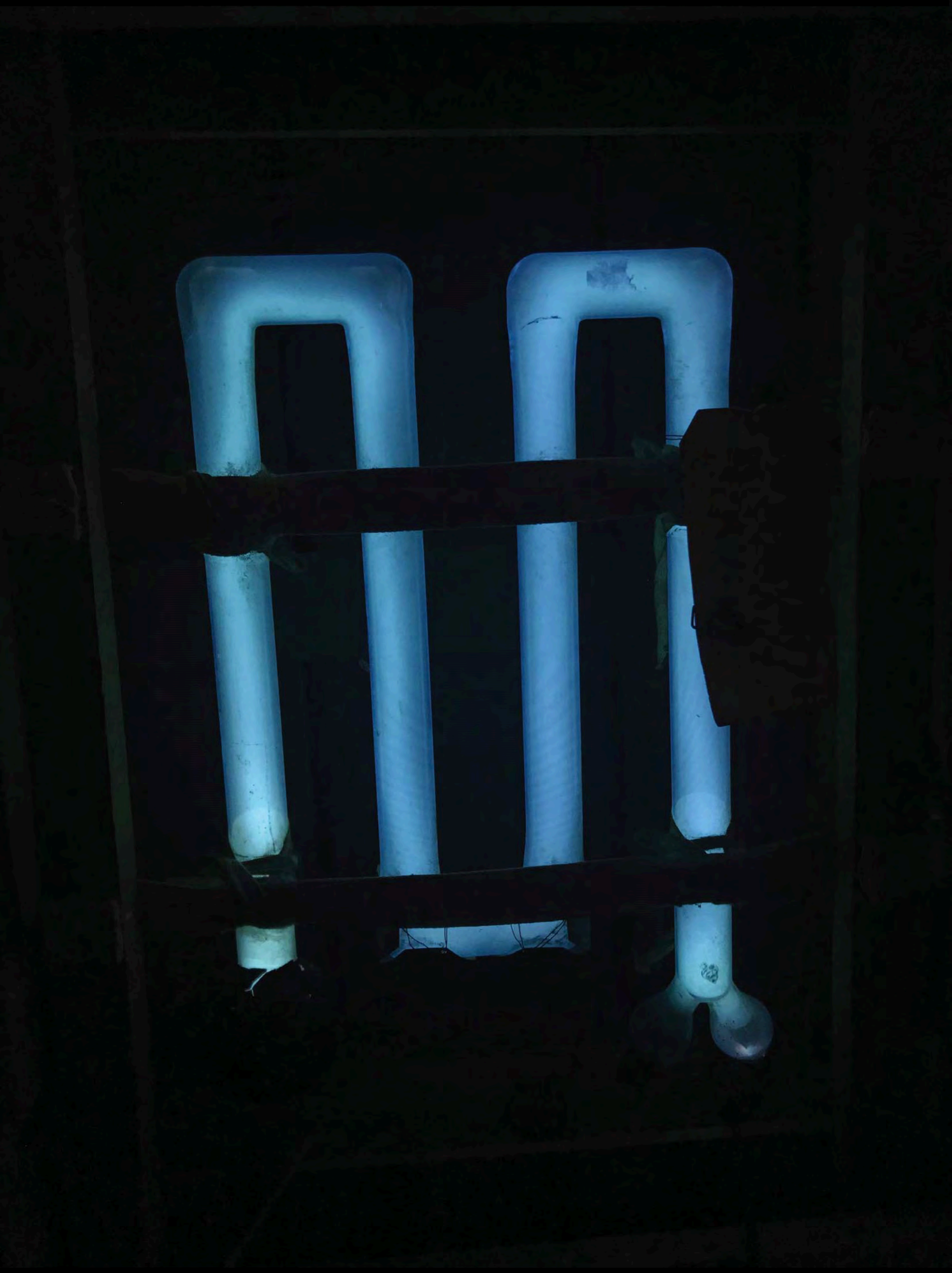
Diathermy Glass Vacuum Electrode: Geissler tube used for treatment of the throat

Diathermy Glass Vacuum Electrode: Geissler tube used for treating the eyes

Diathermy Glass Vacuum Electrode: Geissler tube used for treating the cervix

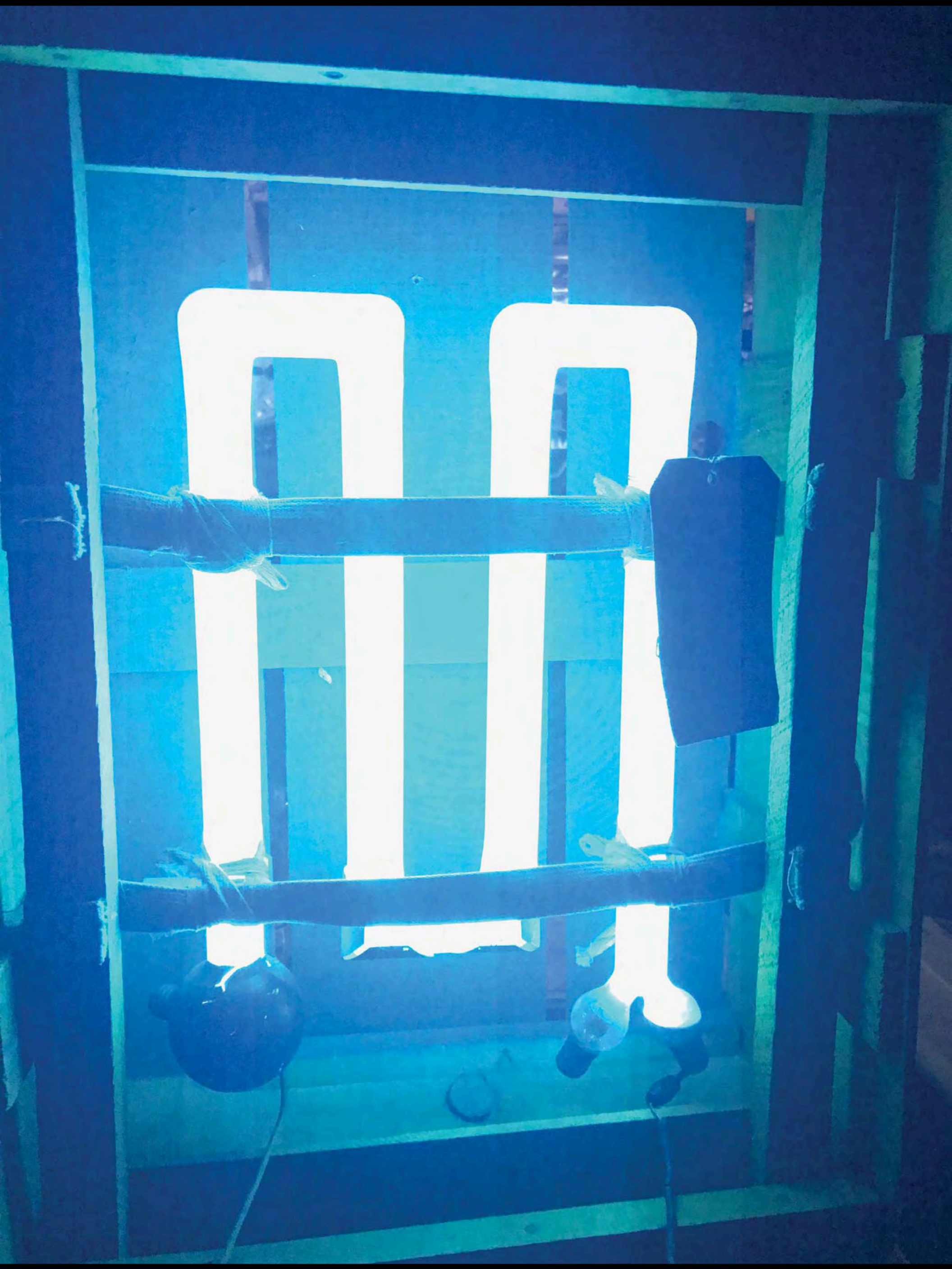
Cooper Hewitt: Early Mercury Vapour Lamp in original shipping crate.

Cooper Hewitt: Starting the lamp, ionization occurs only on one side...



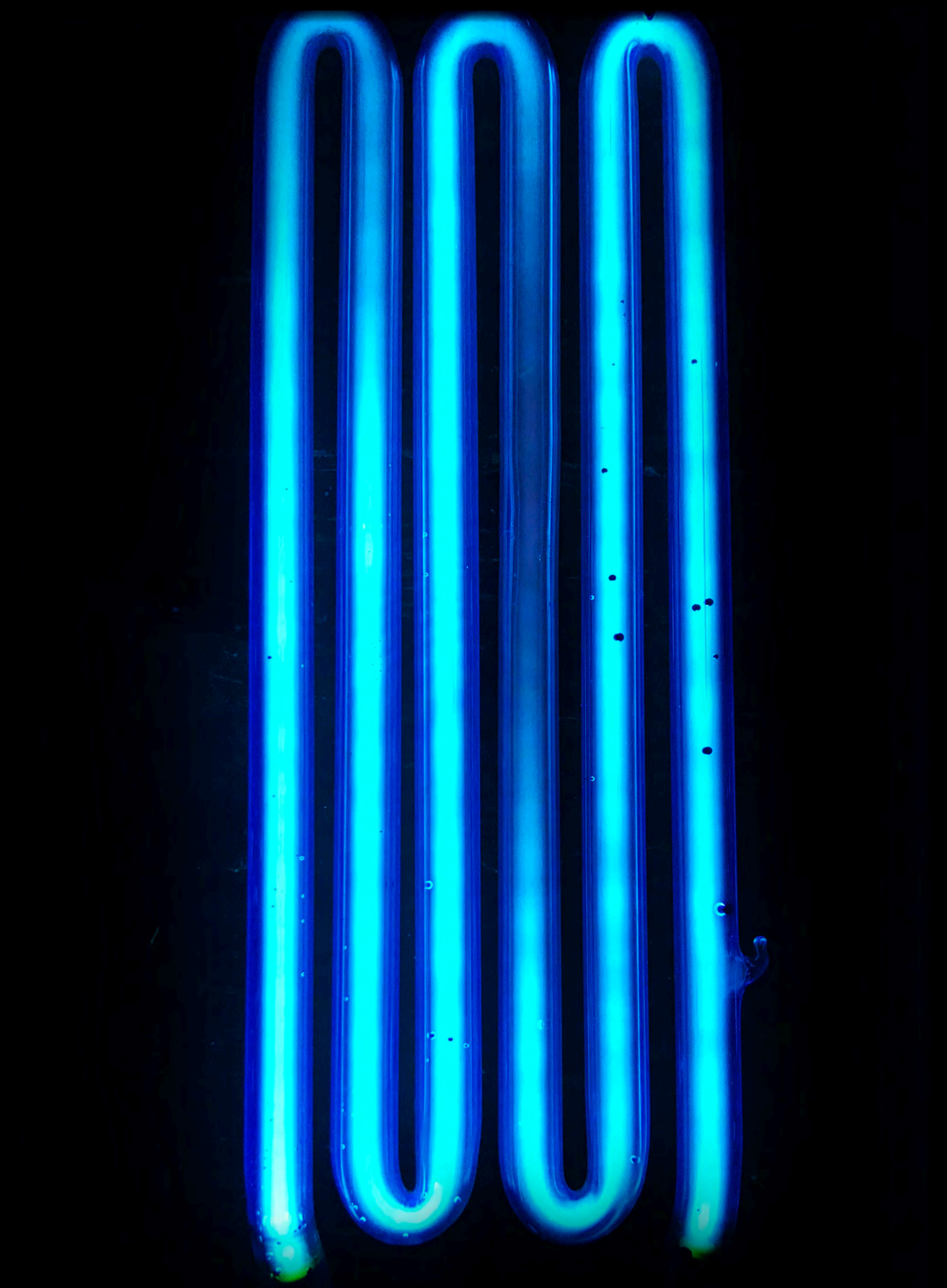
Cooper Hewitt: As the lamp is tilted the mercury ionizes across the tube.

Cooper Hewitt: Once ionized the mercury begins to boil and the lamp begins to pressurize inside...



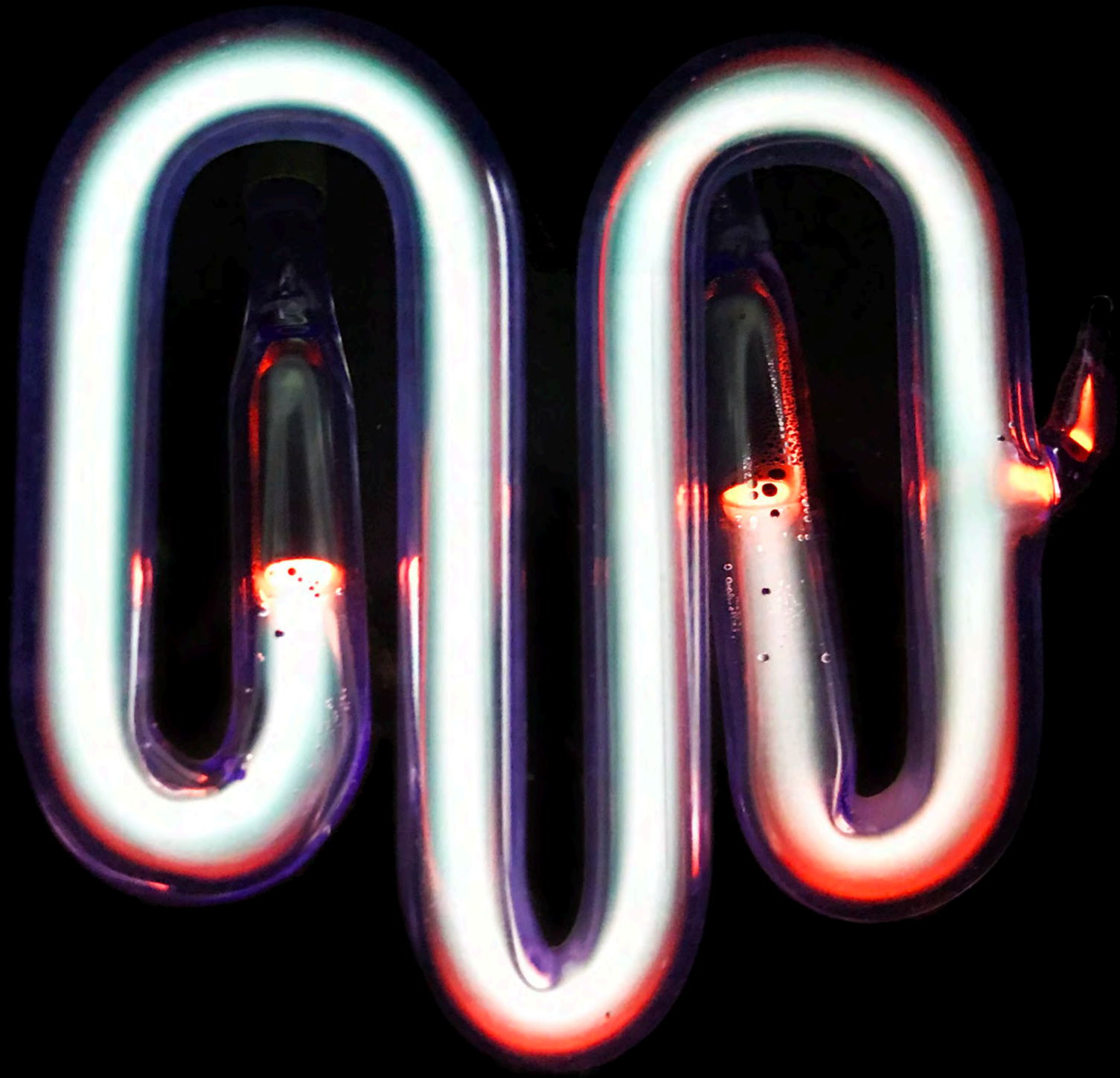
Cooper Hewitt: Lamp operating at full brightness.

Early prototype quartz ultraviolet lamp with uranium glass electrodes

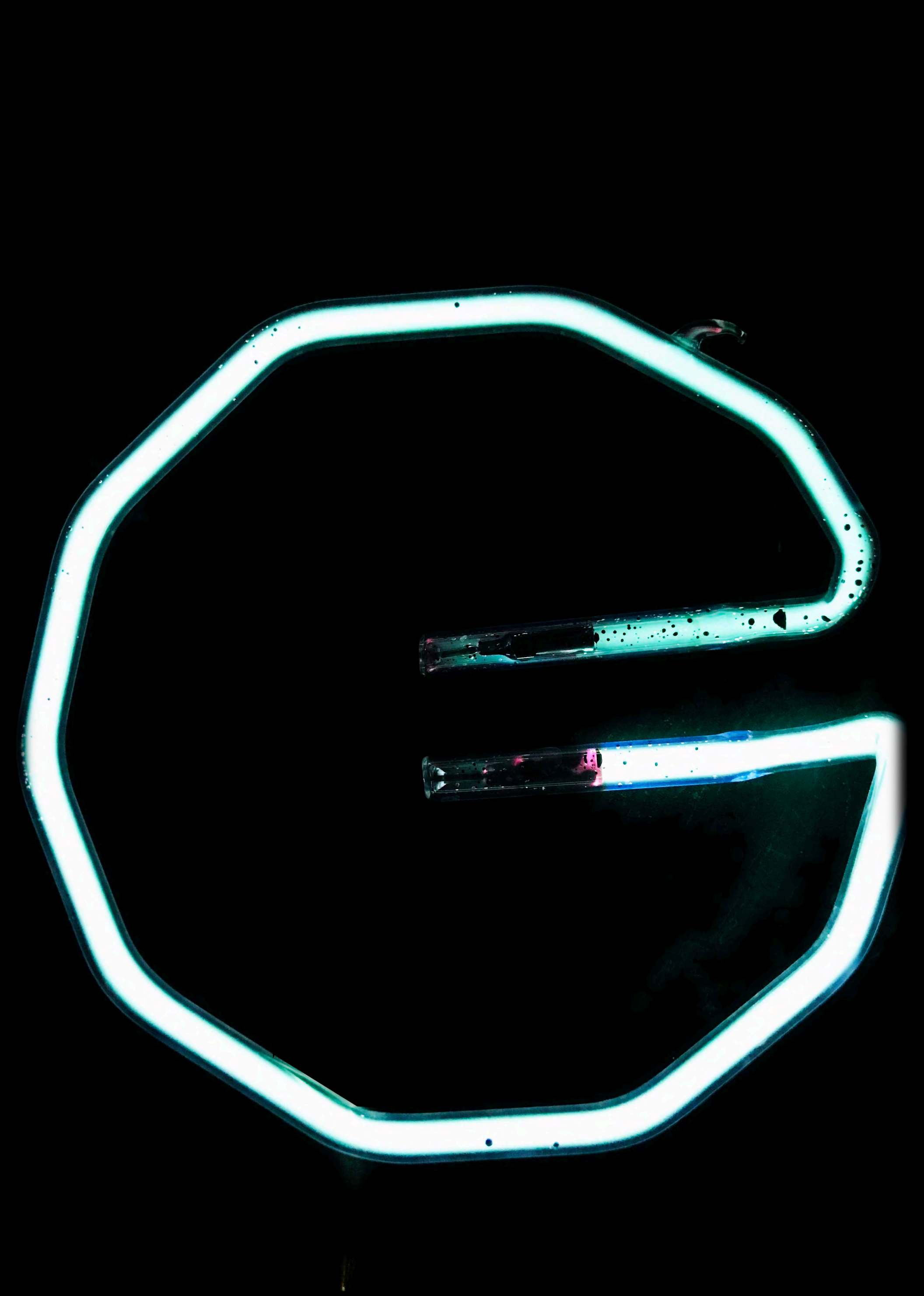


Early prototype quartz ultraviolet lamp with uranium glass graded seal

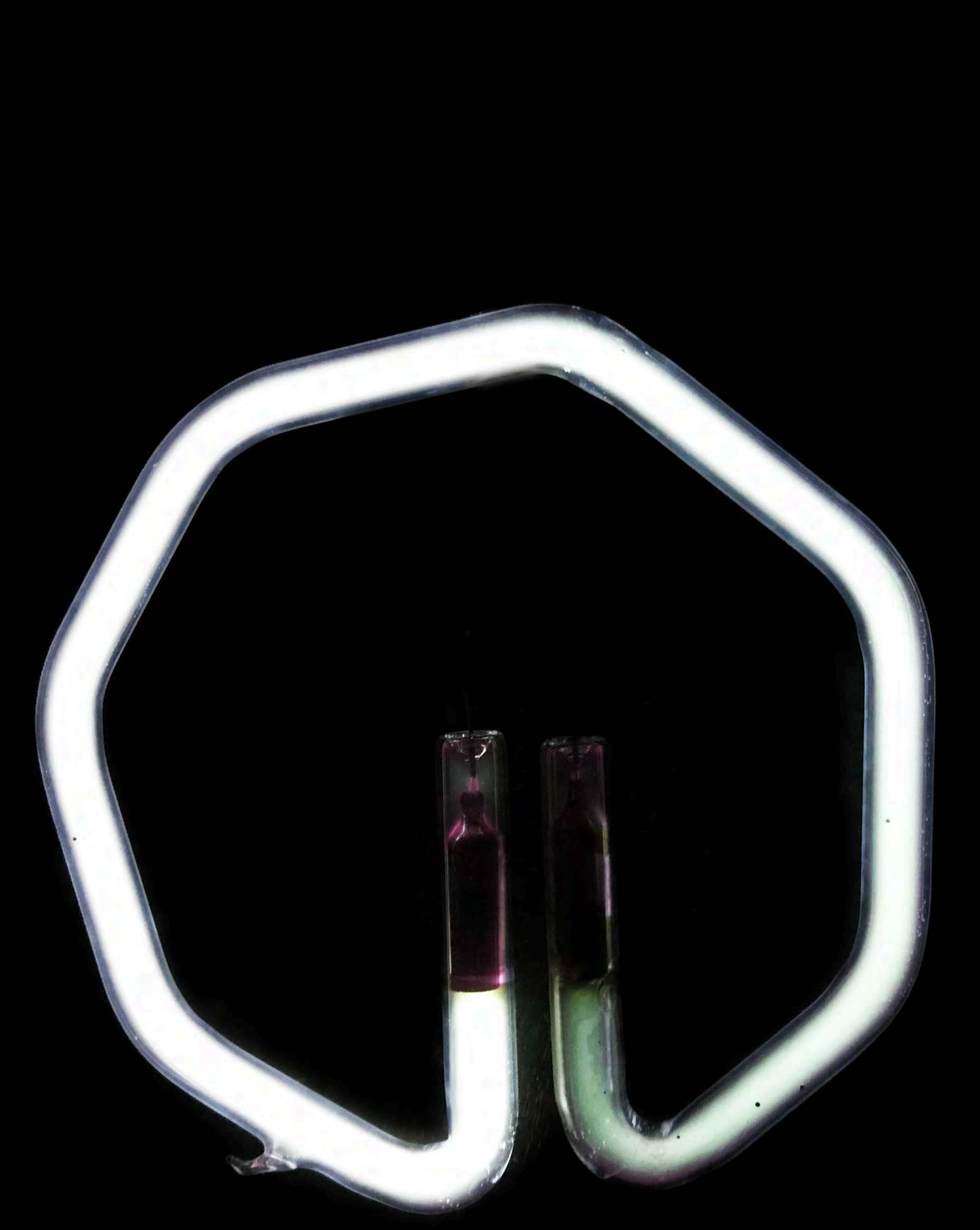
Early prototype quartz ultraviolet lamp with cast metal electrode seal



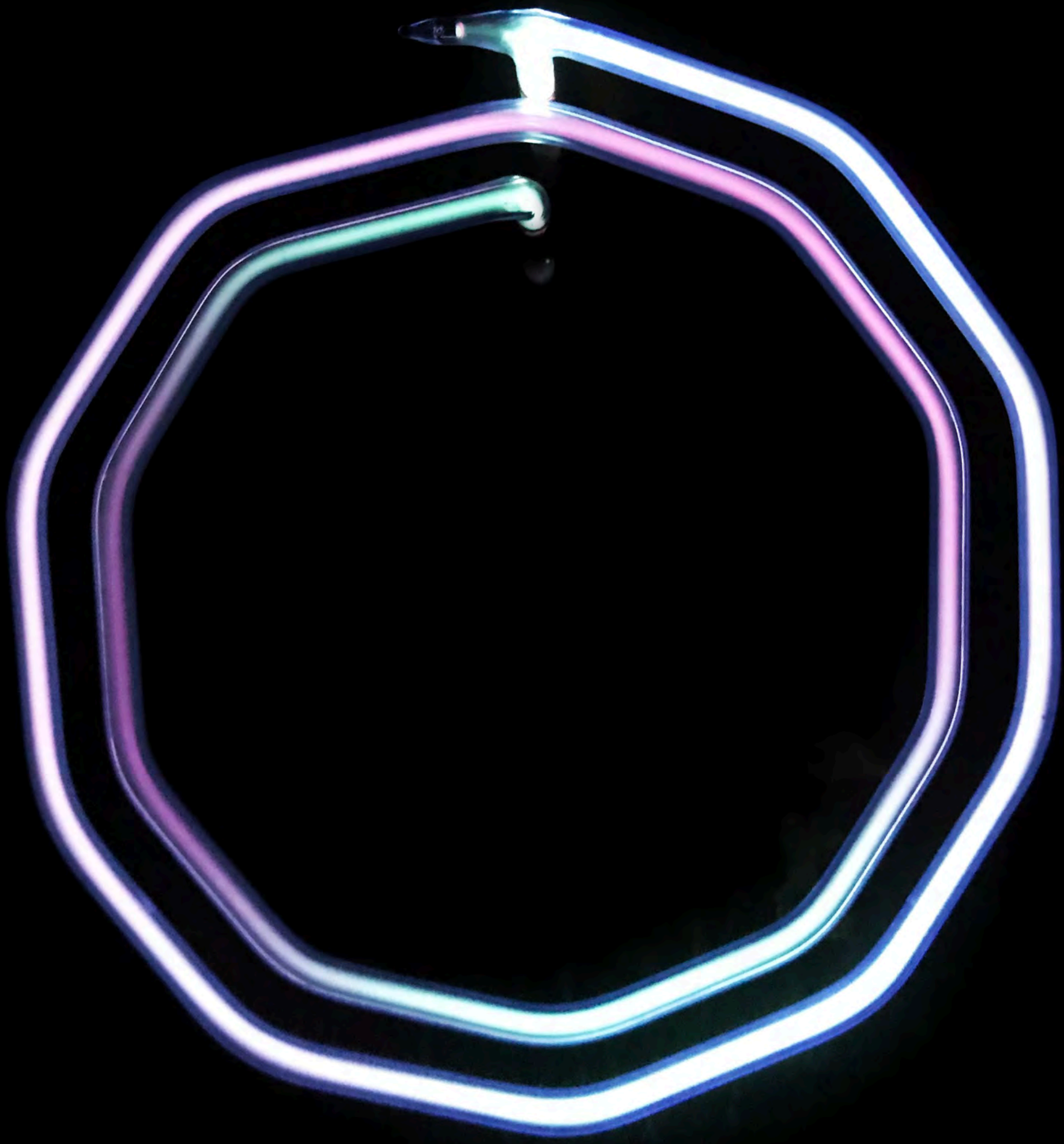
Early prototype quartz ultraviolet lamp with neon gas and cast metal electrode seal



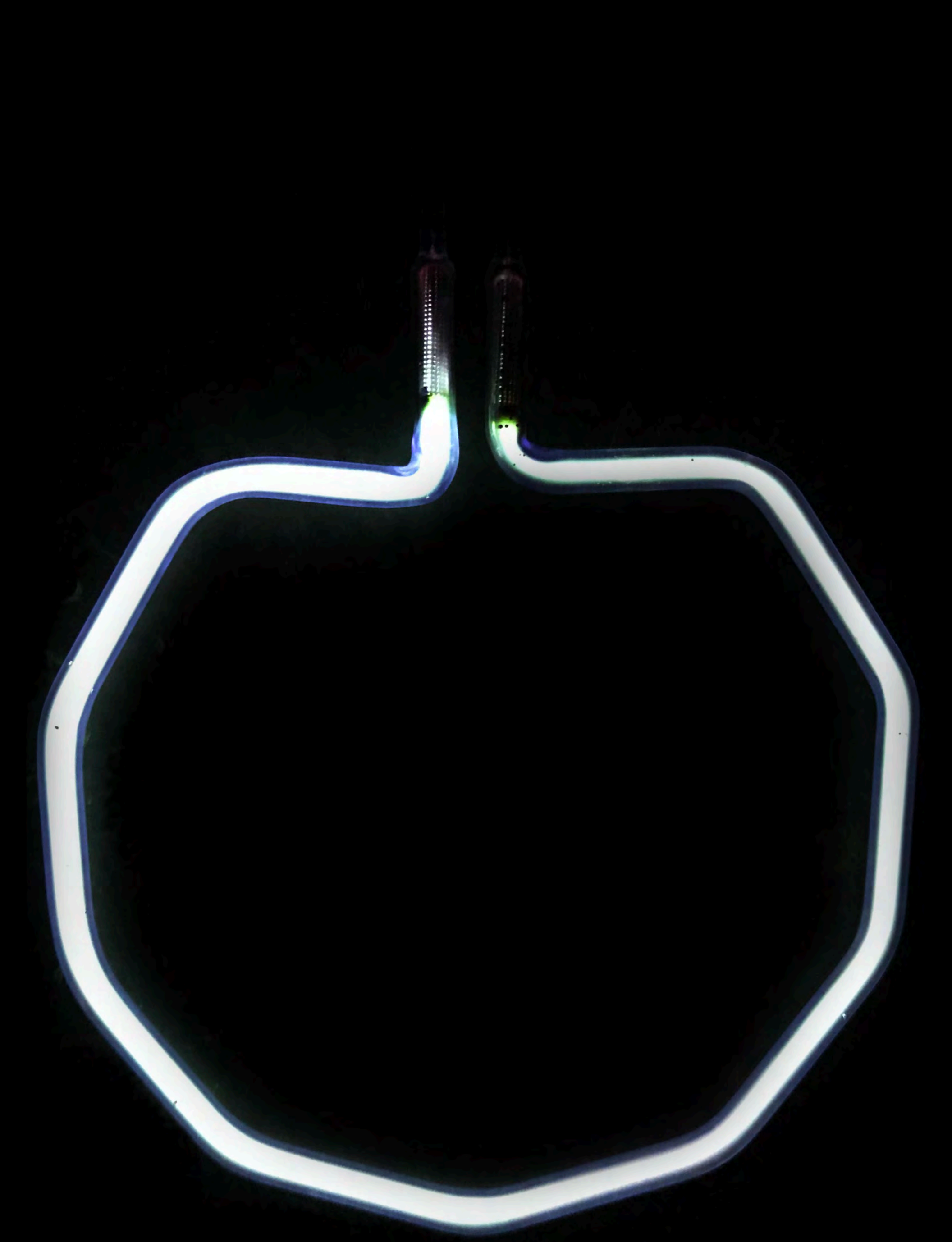
Early prototype quartz ultraviolet lamp with neon gas



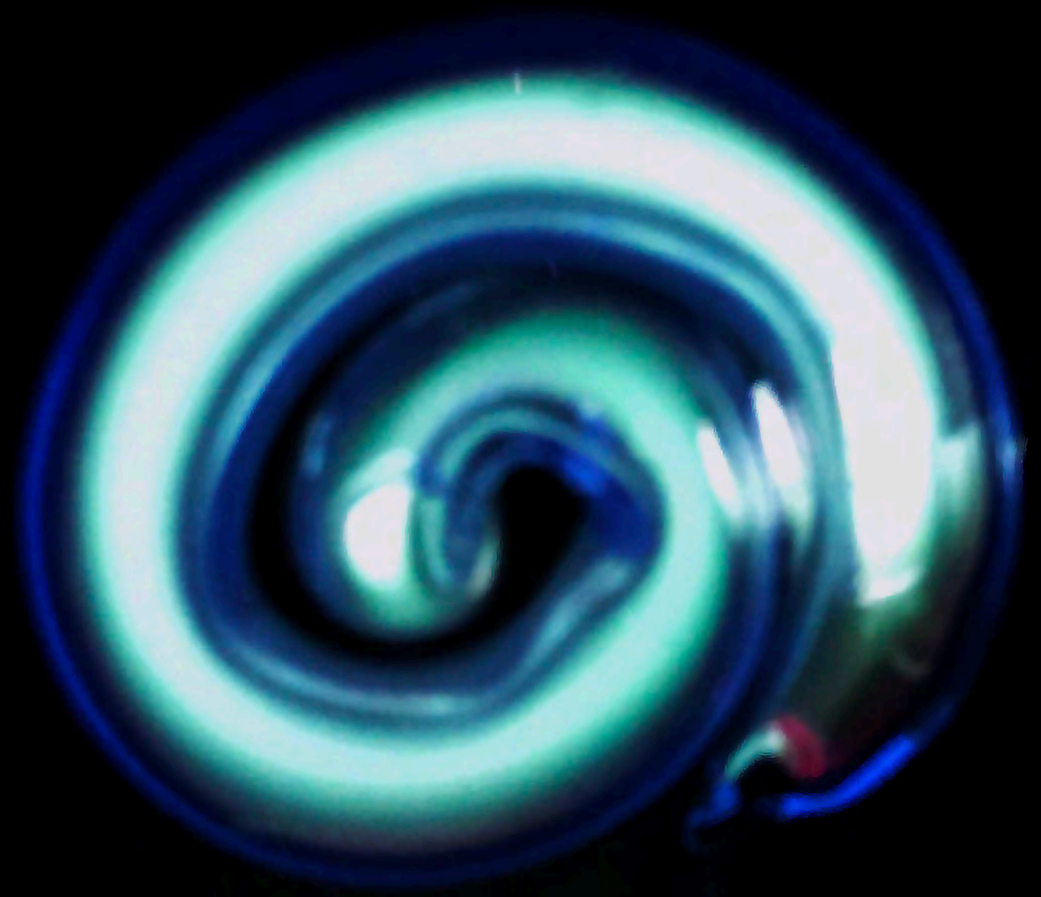
Early prototype quartz ultraviolet lamp with neon gas



Early prototype quartz ultraviolet lamp with nitrogen gas



Early prototype quartz ultraviolet lamp with with mesh electrodes

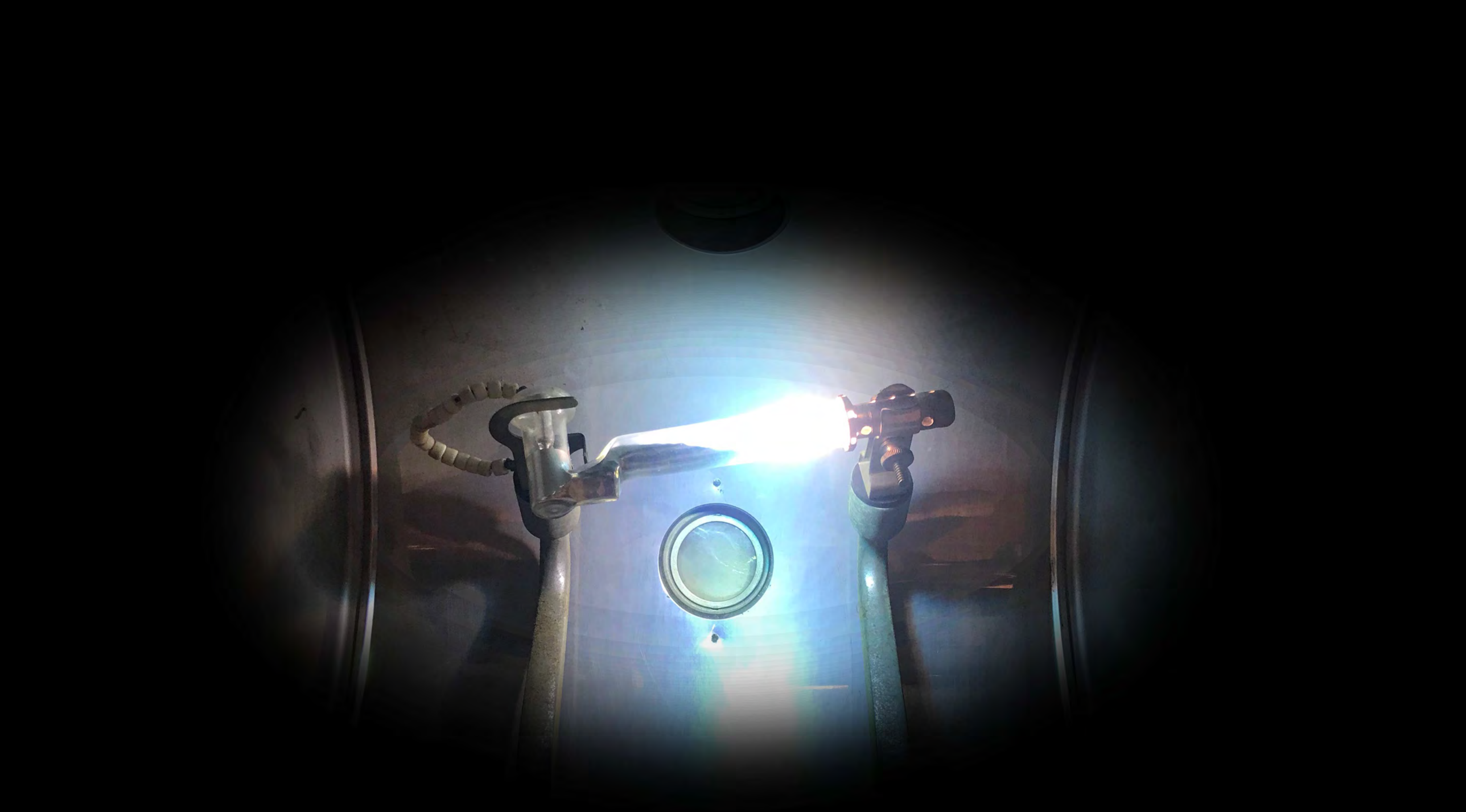


Early prototype quartz ultraviolet lamp for spot treatment of skin conditions

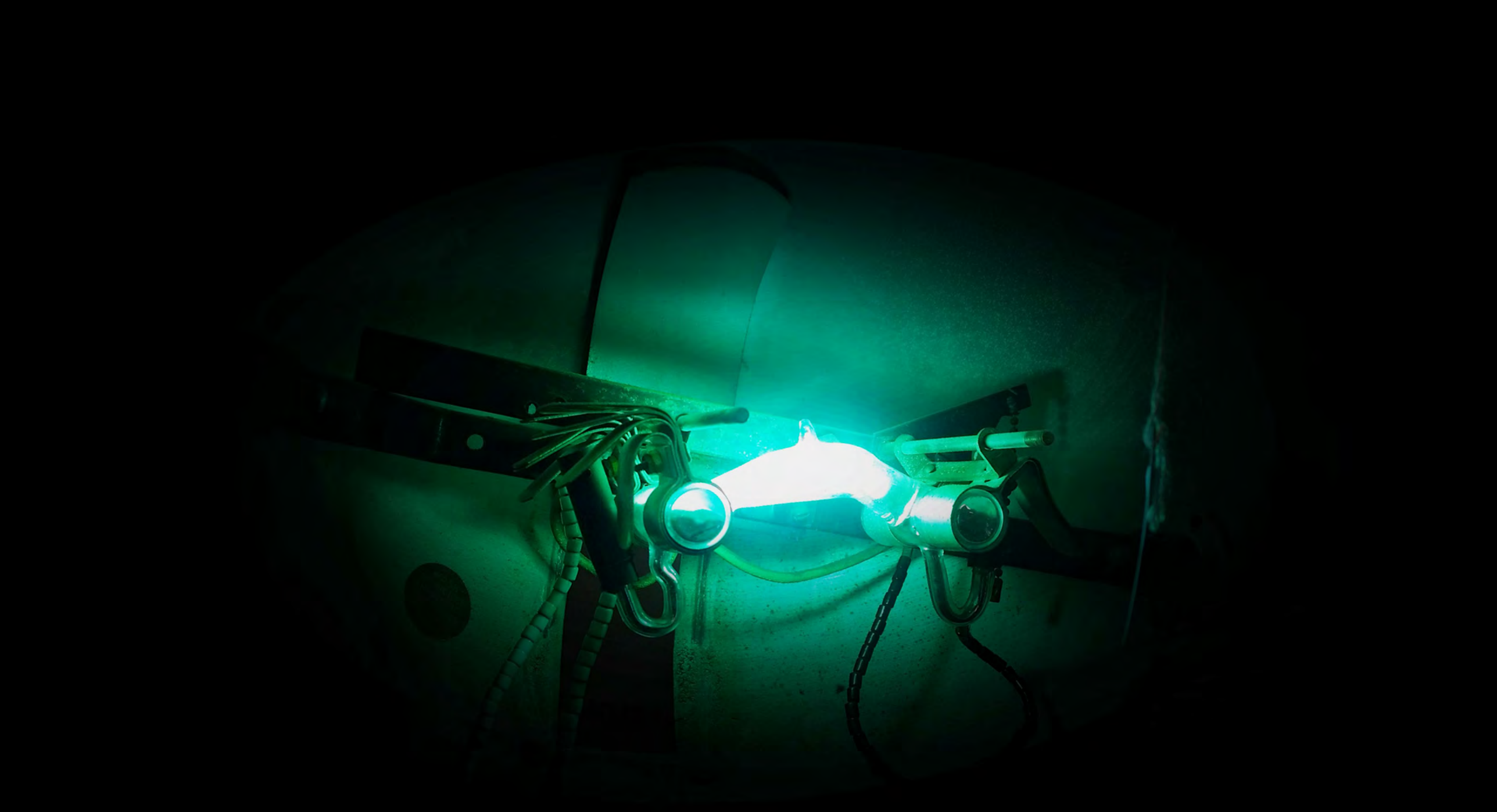
1920's Sun Lamp made by E. J. Rose

Early Cooper-Hewitt UV Lamp for Alternating Currents

Cooper-Hewitt UVIARC Lamp for direct currents



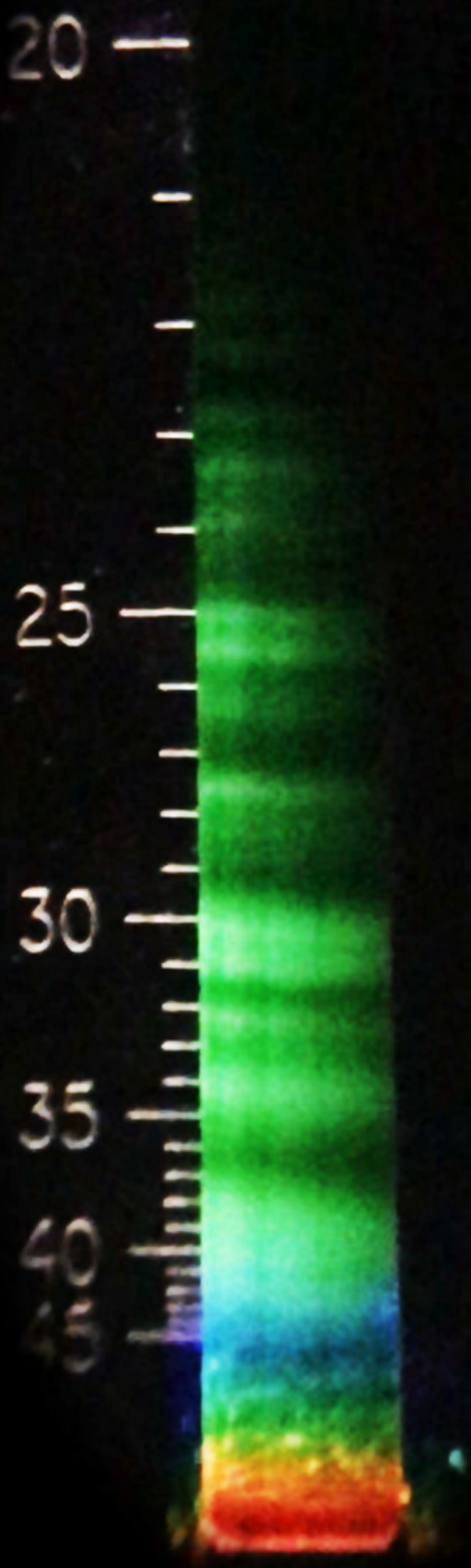
Cooper-Hewitt Lamp for direct currents, fully lit operating at 1100°F



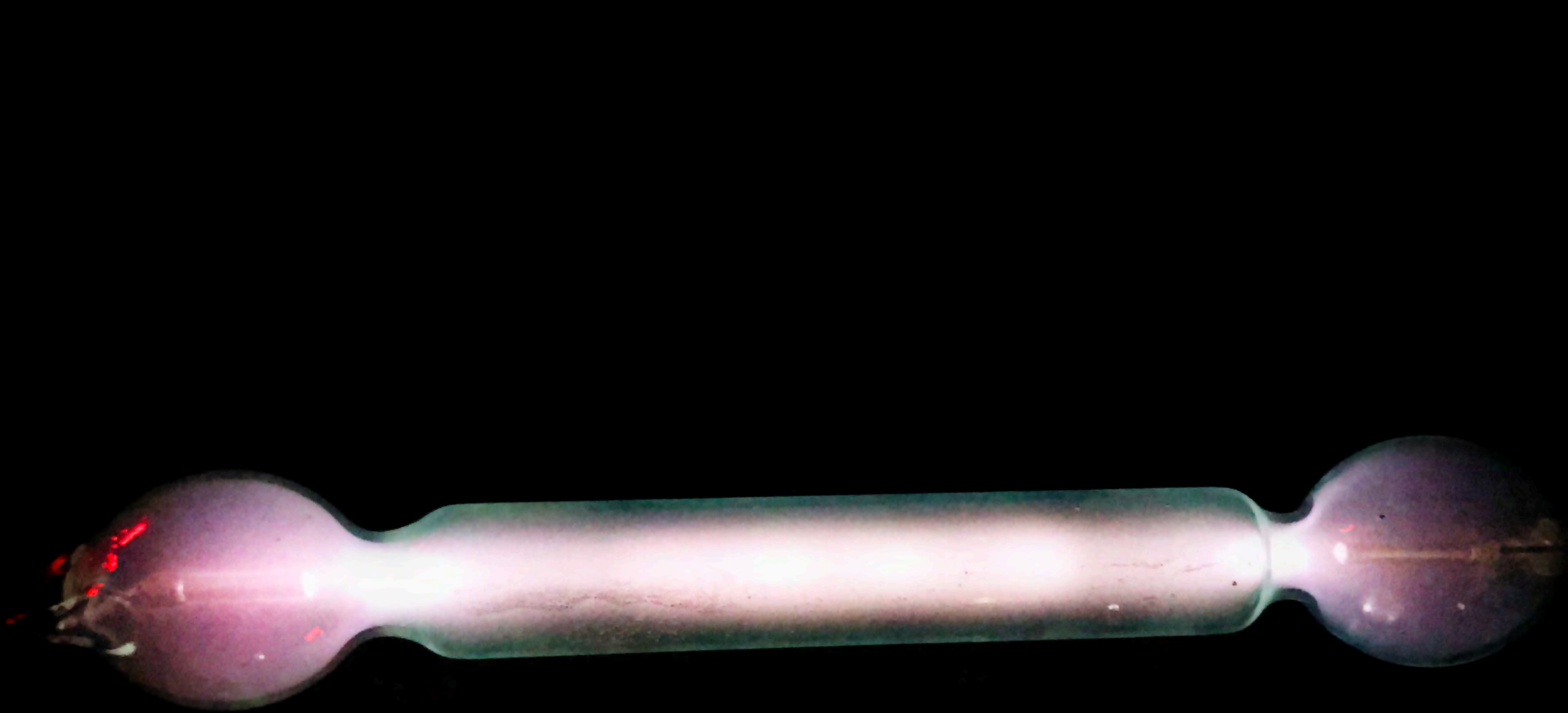
Hanovia "Alpine Sun Lamp" operating from 104V direct currents

Kromayer Water-Cooled UV Lamp operating from direct current: First UV lamp to produce 185nm wavelength of radiation

Tungar Rectifier Bulbs used in direct current mercury vapour lamp power supplies

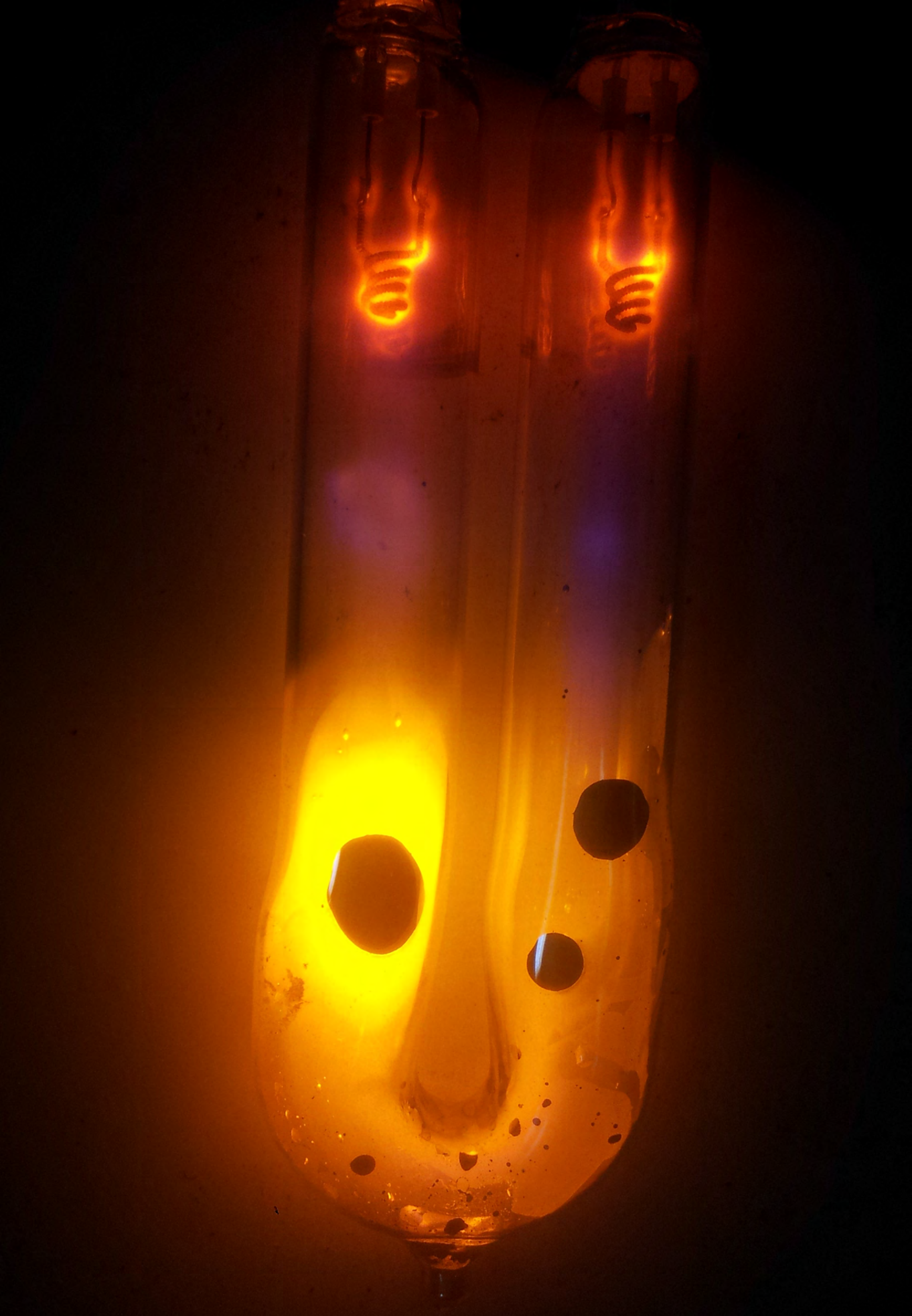


UV Spectrograph of Carbon Arc lamp using "Therapeutic Carbons"

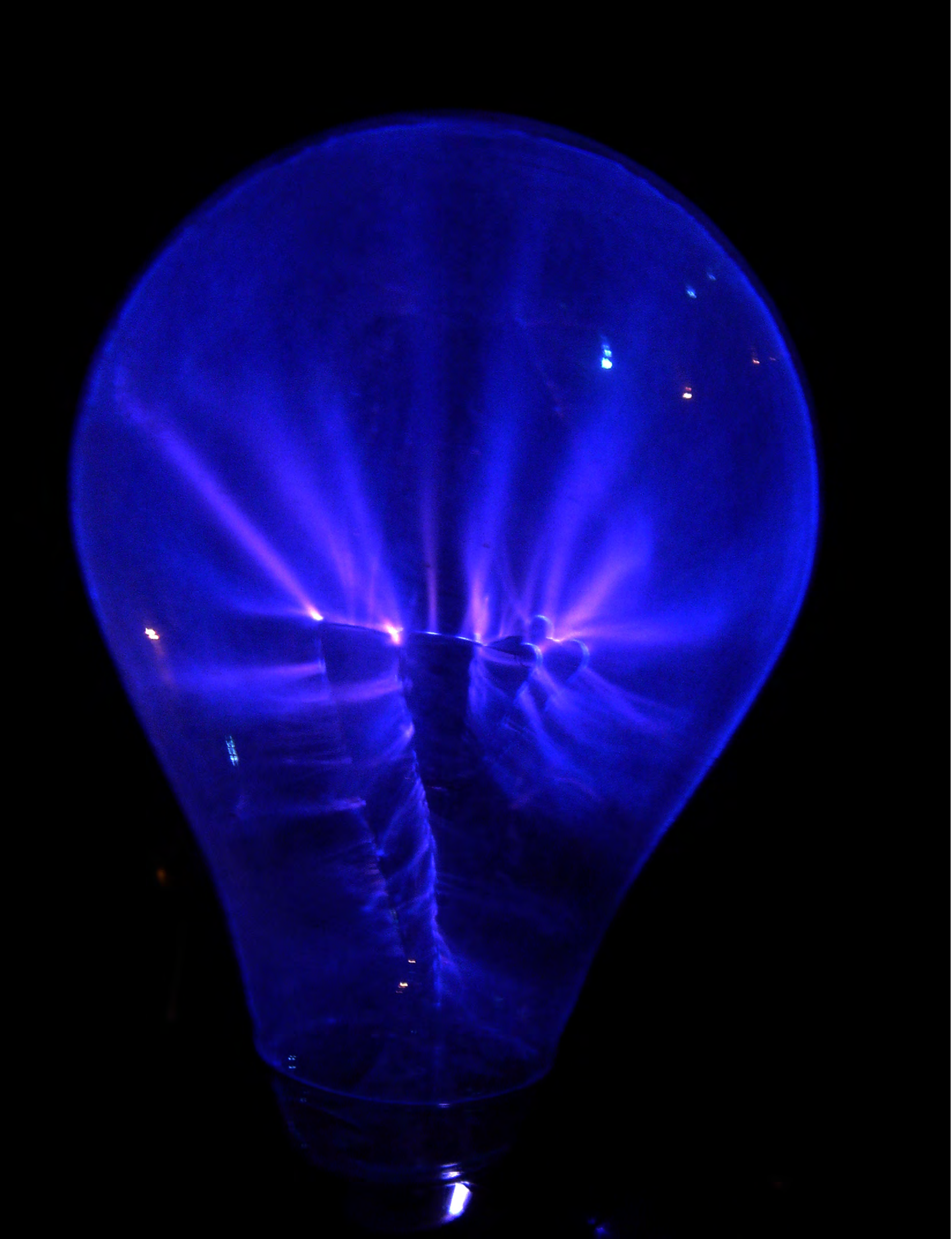


Sir Humphrey Davy lamp proving mercury could be ionized in a non-striking (ultra-high) vacuum

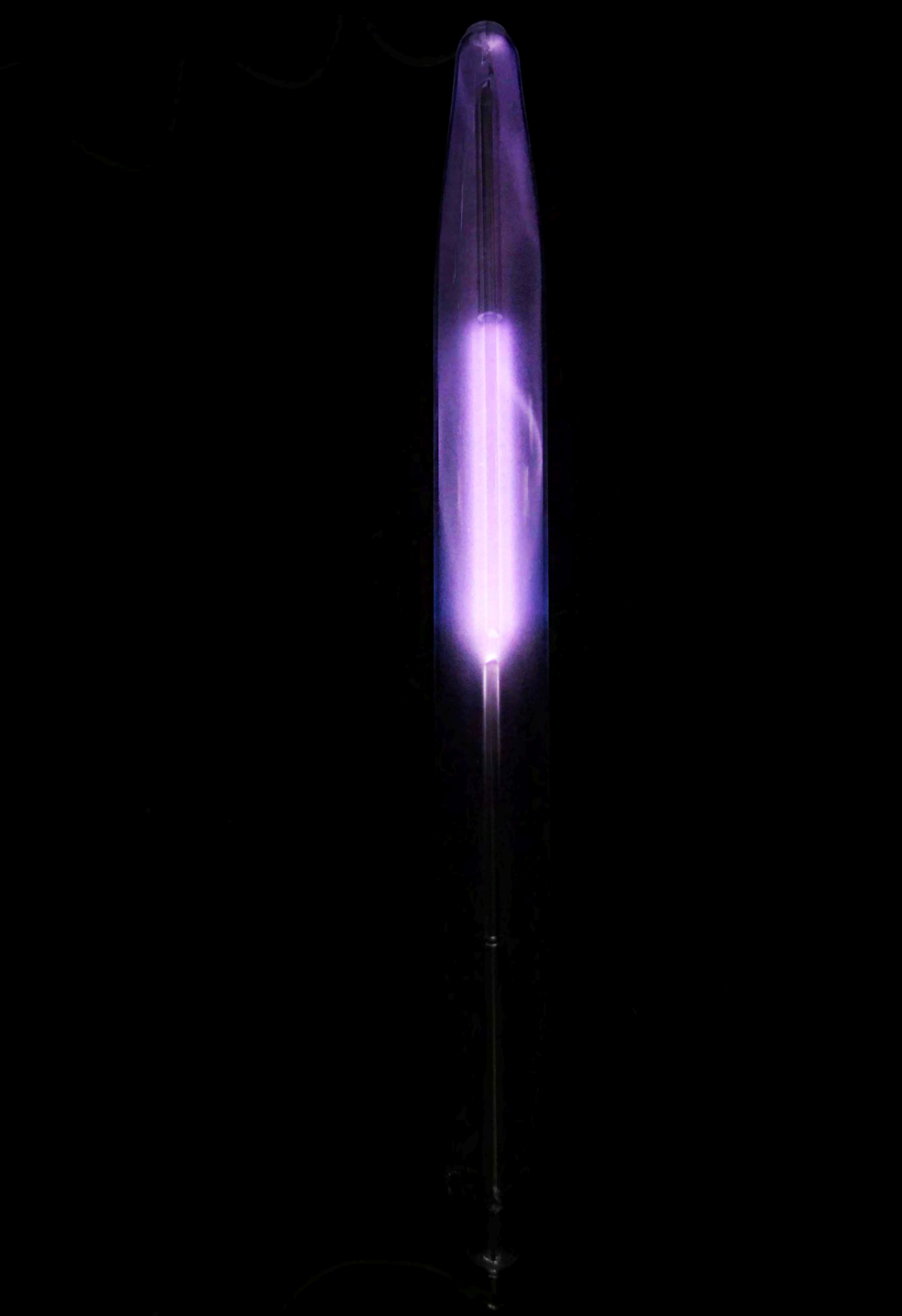
Spectrum Tube: Geissler Tube used to study wavelengths of light emitted by certain gases.
This tube contains nitrogen gas.



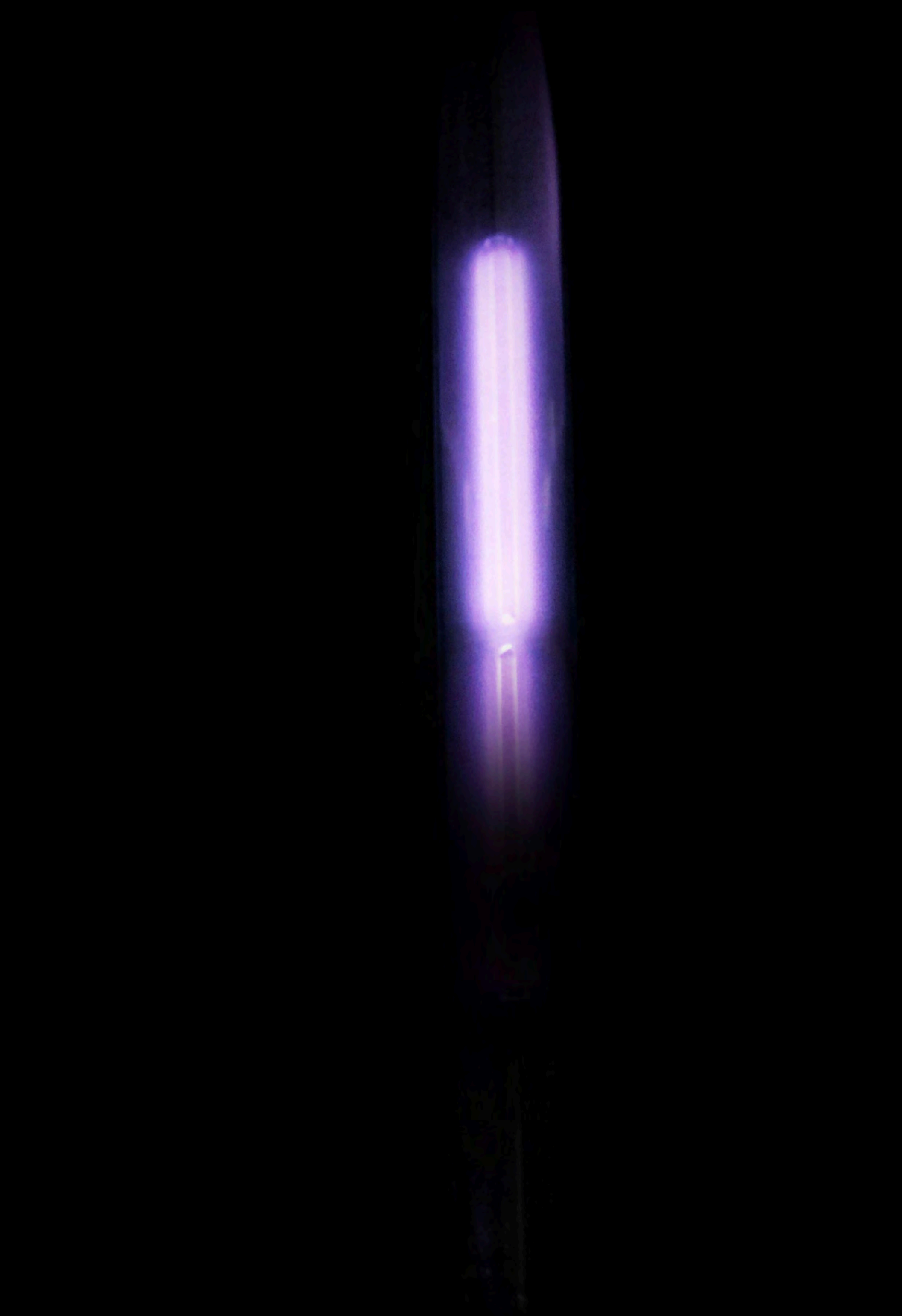
Low Pressure Sodium Lamp: Geissler Tube containing sodium metal that emits near monochromatic light. (589.0 and 589.6 nm spectral lines only)



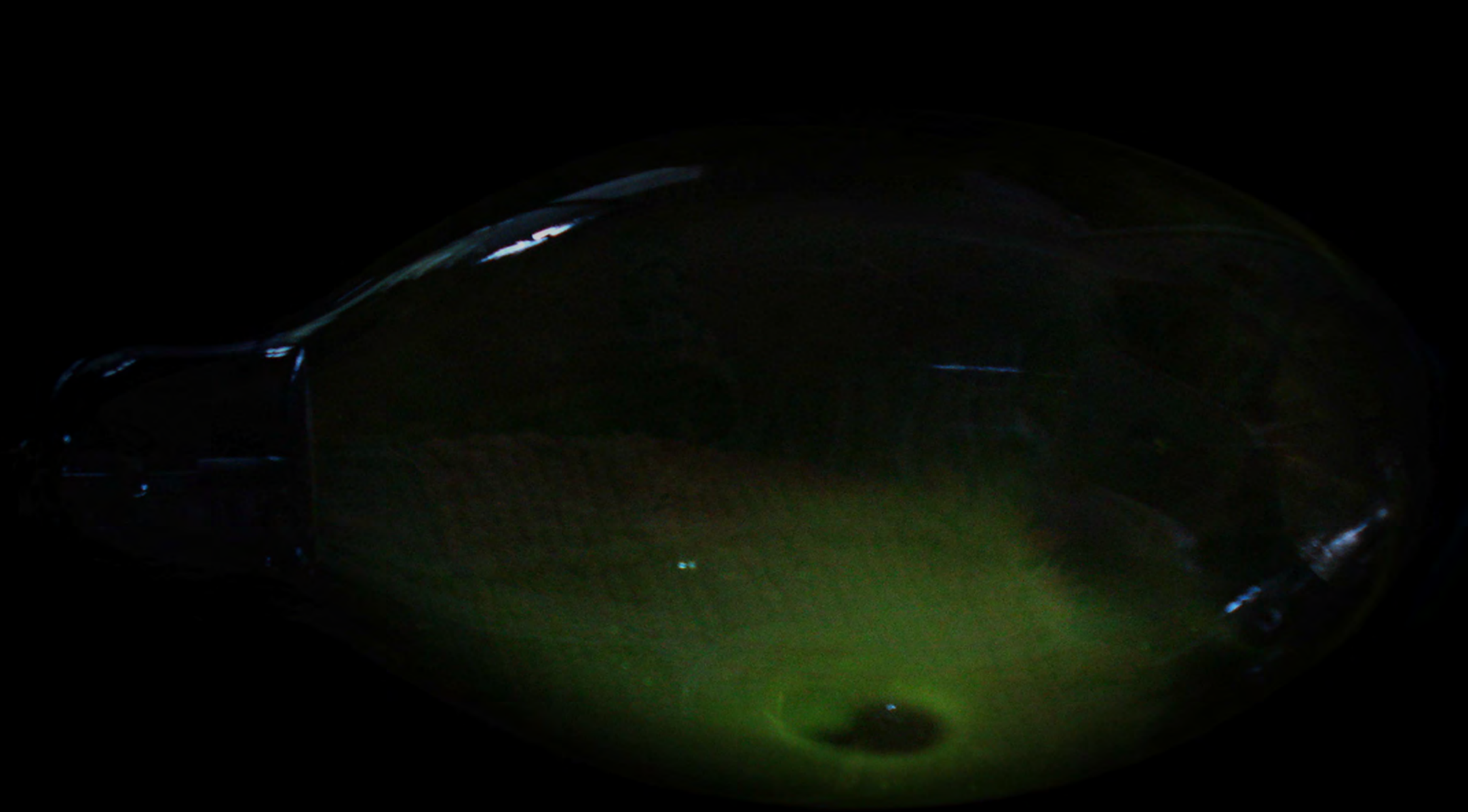
Nitrogen gas ionized with 30,000V in a modern light bulb.



Ruhmer's Ondoscope: Geissler Tube used to show polarity of electrical sources or sparks
When connected to a direct current source, the negative pole light up.



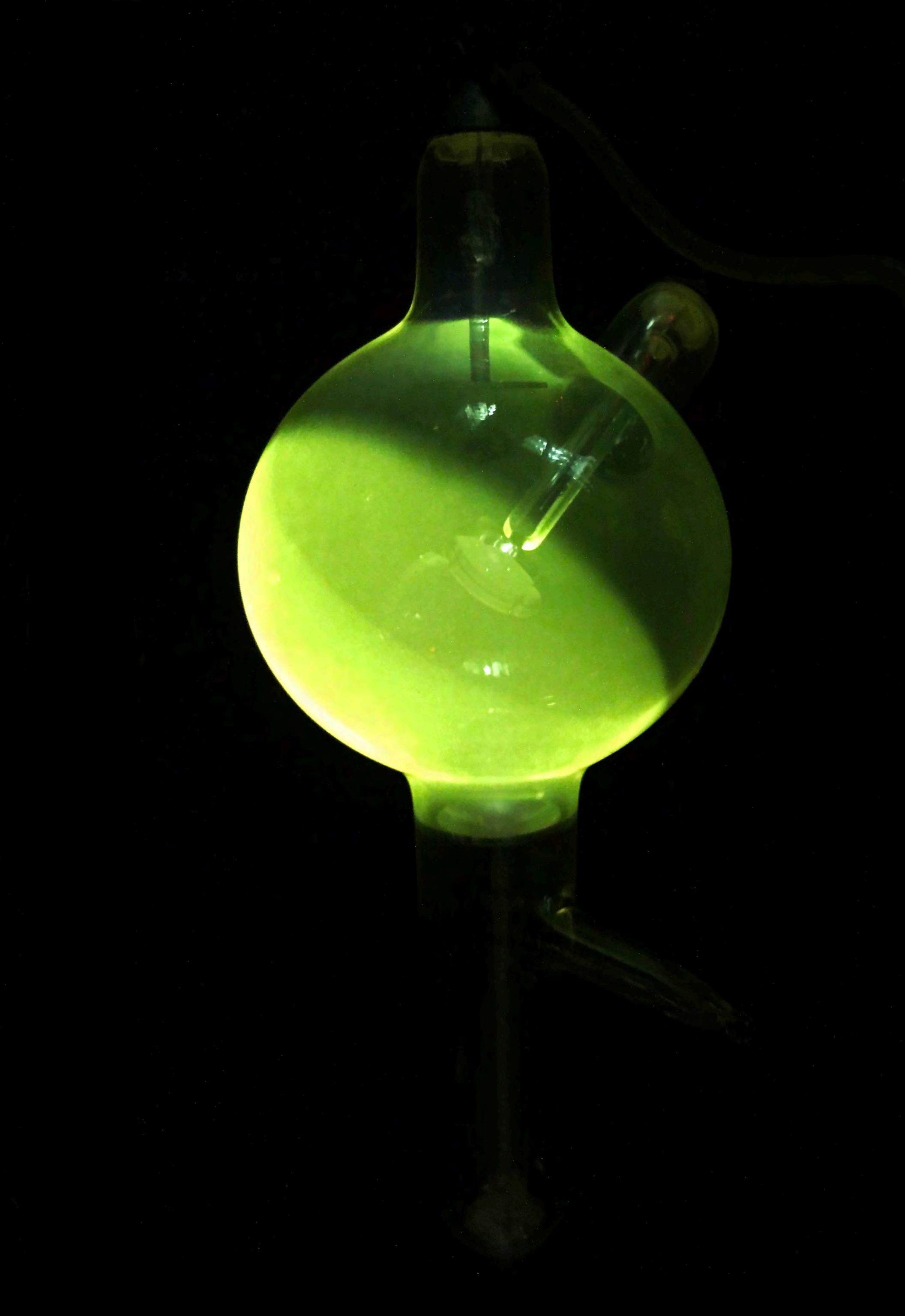
Ruhmer's Ondoscope: If the source isn't a pure direct current (inverse discharges are present) a portion of the other electrode will light as well. On alternating sources both poles light equally.



Thomas Edison X-Ray Tube, 1896, from Frank Jones Collection

Elihu Thomson Double Focus X-Ray Tube from the Frank Jones Collection

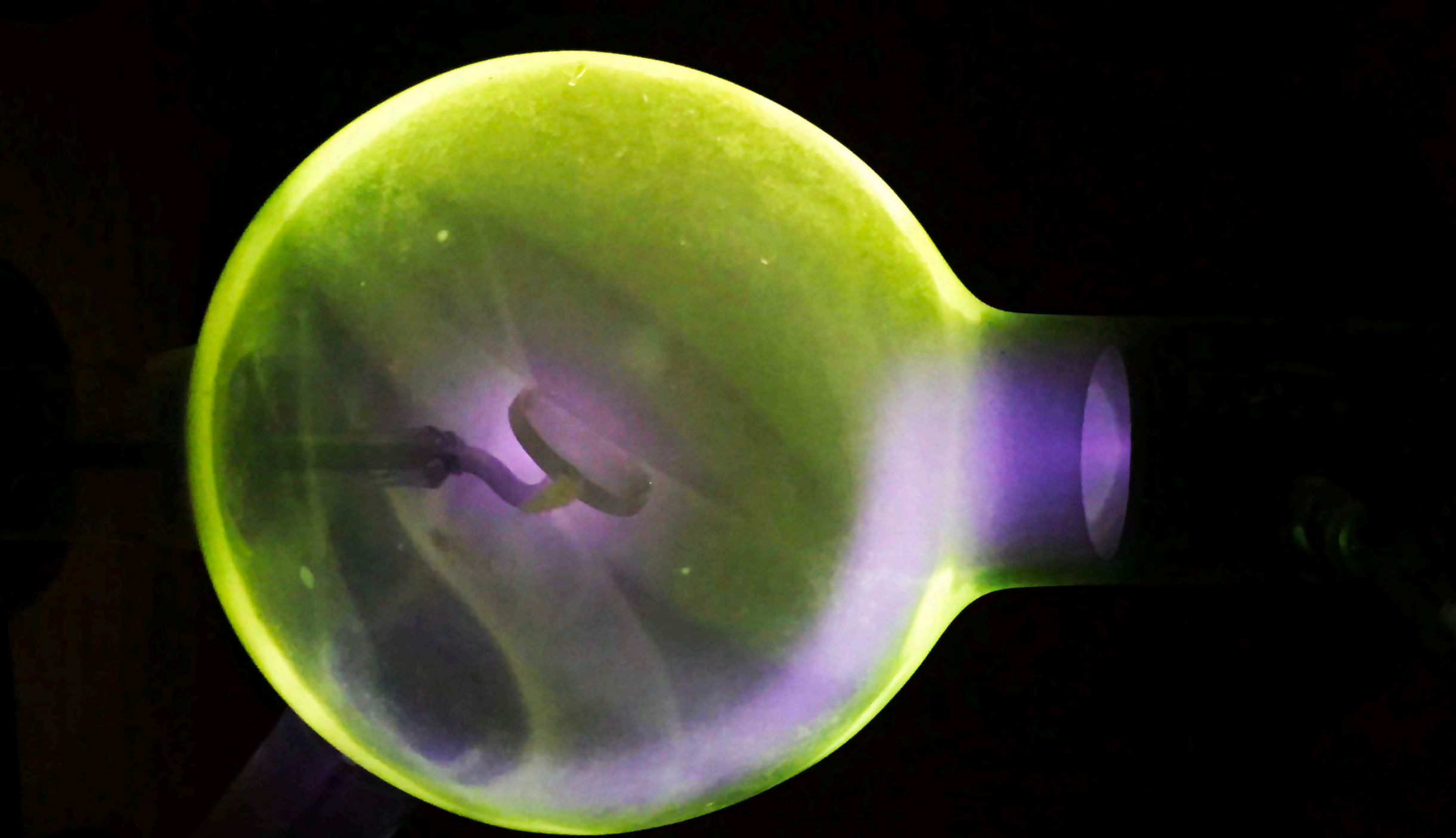
Swett & Lewis Kinraide Coil in operation making X-Rays



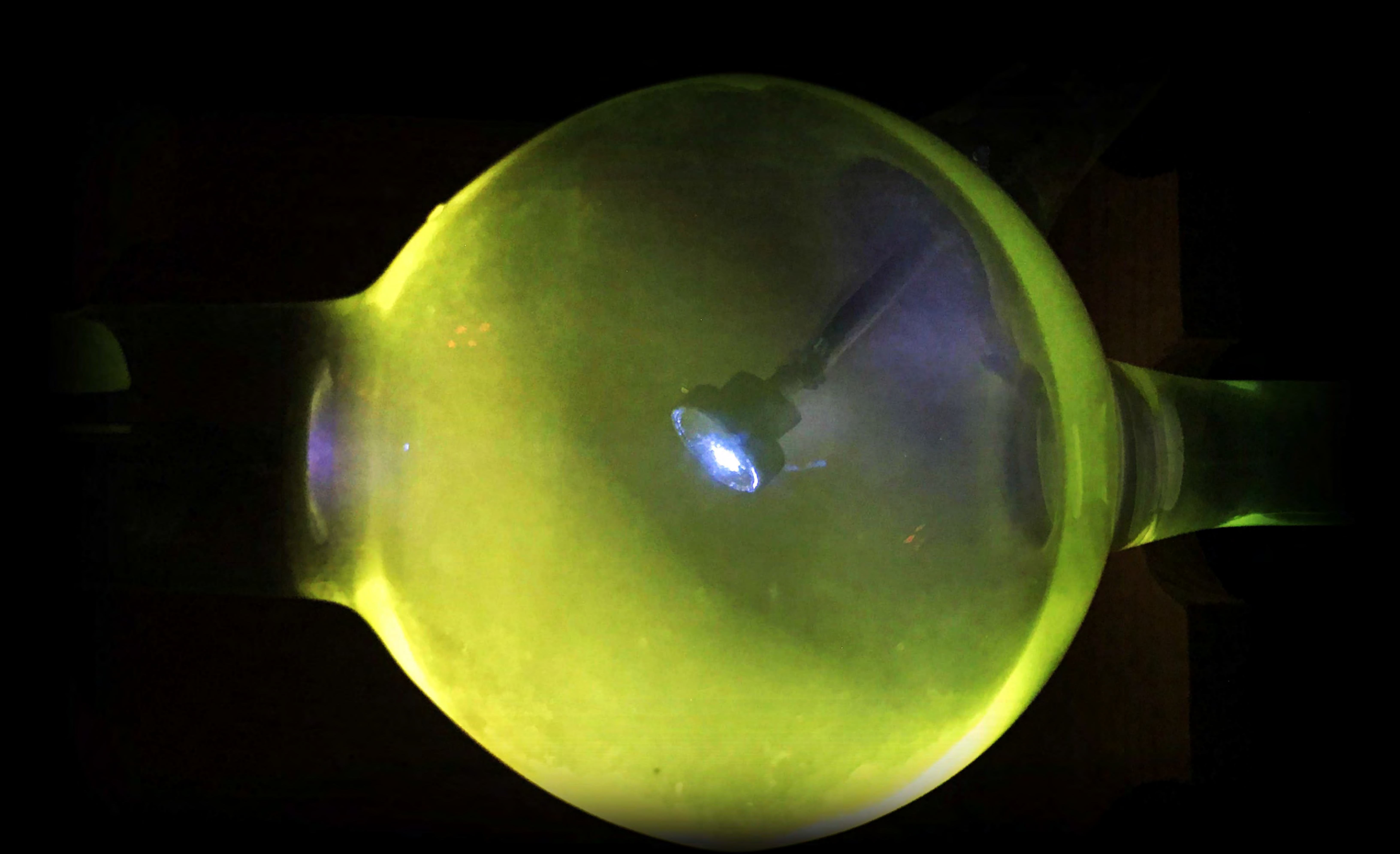
Early X-Ray tube of German origin, 1896

Early X-Ray tube of German origin, 1896

Early German X-Ray tube made by the famous Pressler firm.

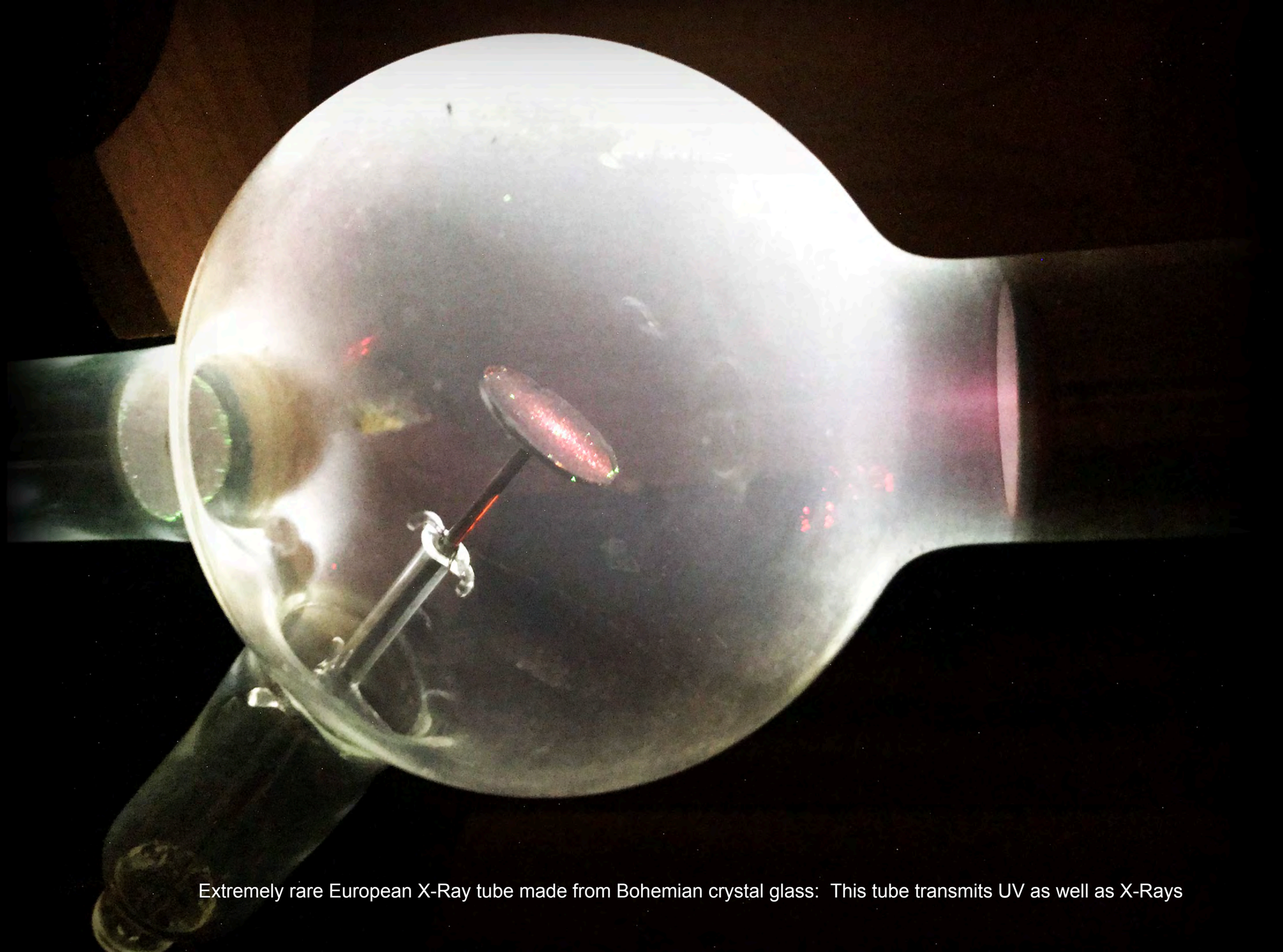


Early German X-Ray tube: Note that the violet glow indicates the vacuum is becoming too low ("soft") to produce quality X-Rays

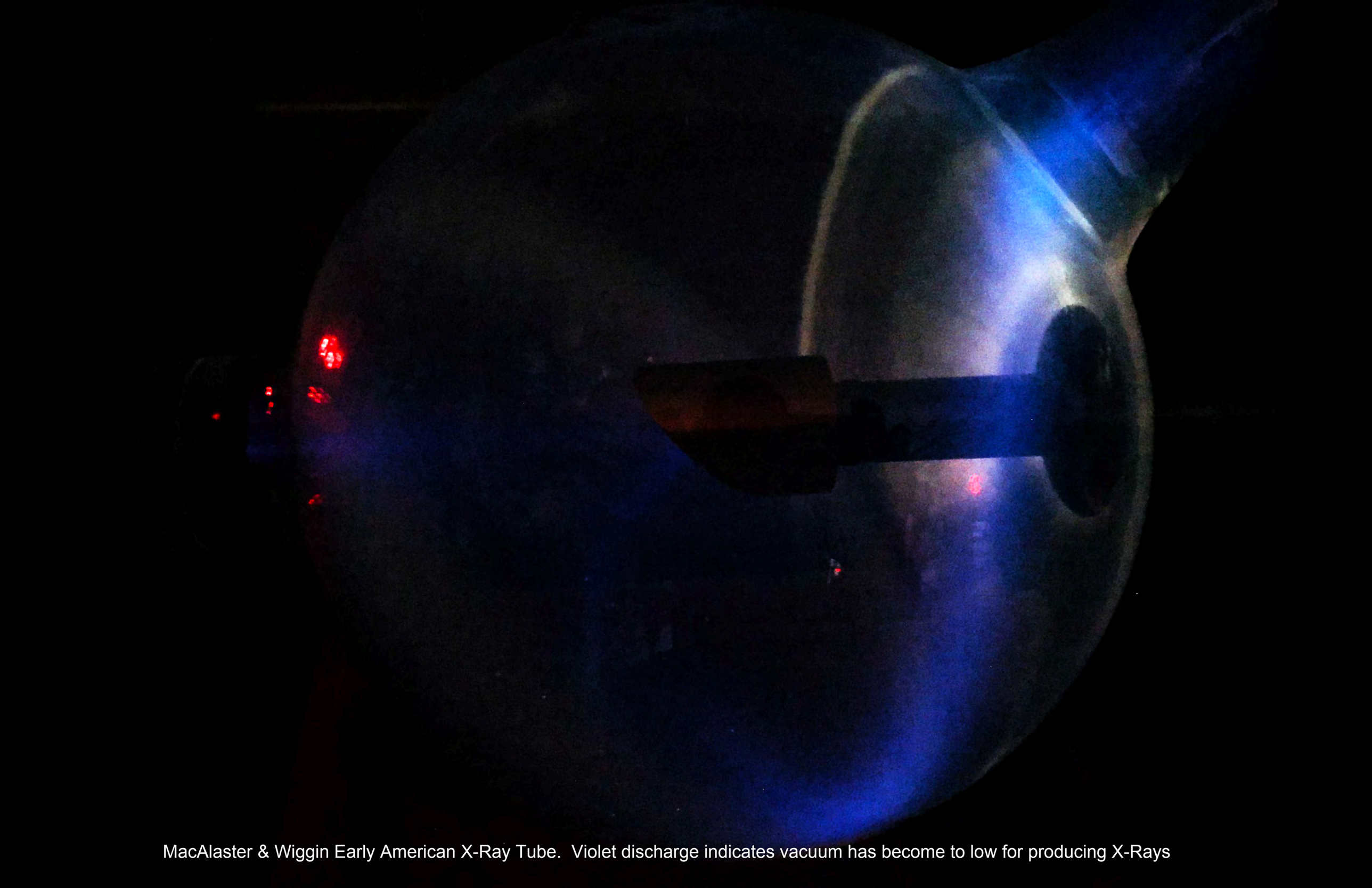


Early German X-Ray tube made by the famous Pressler firm. The white spot on the platinum target is a result of heating from X-Rays known as molecular bombardment.

Early German X-Ray tube made by the famous Gundelach firm.

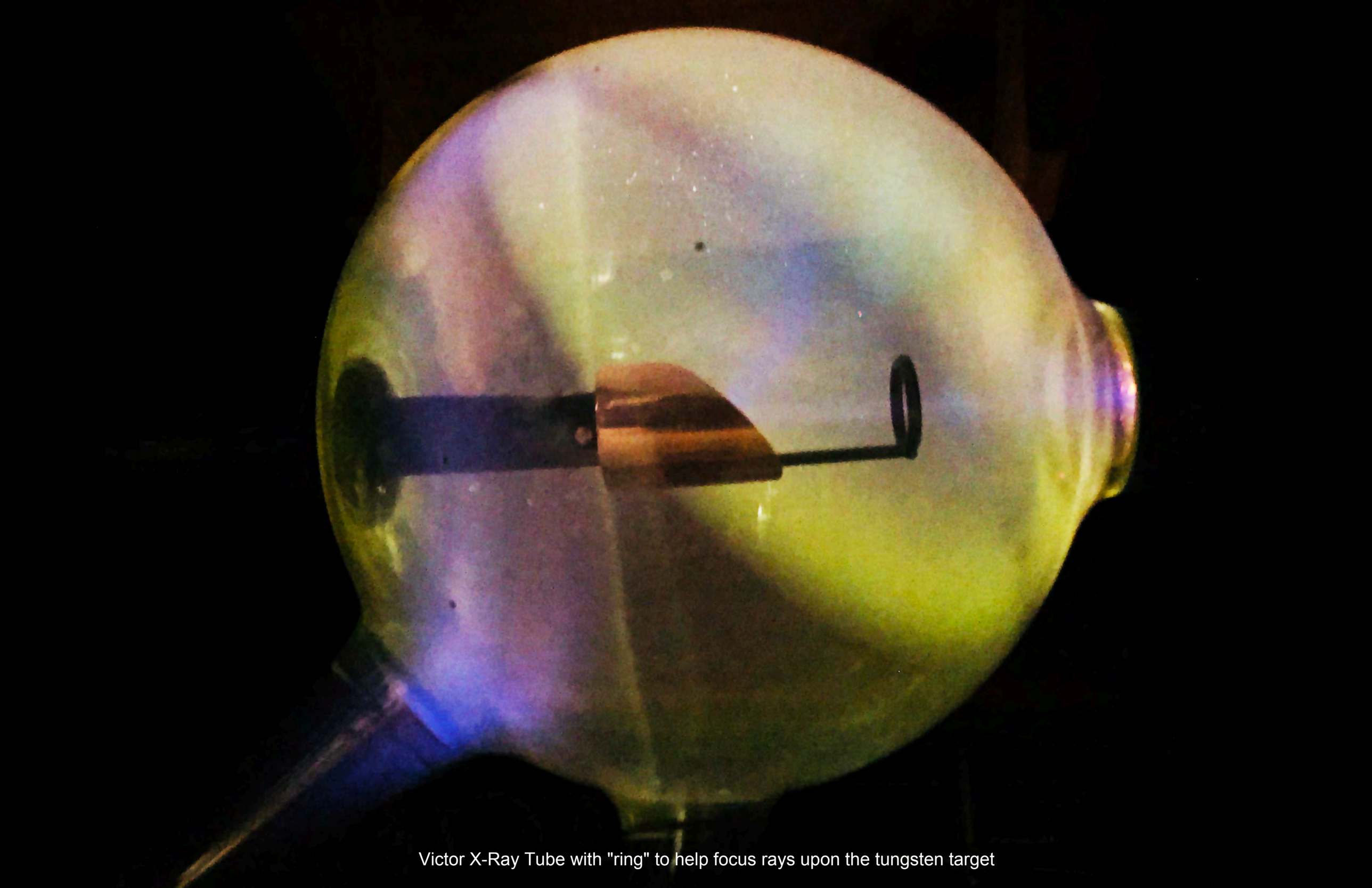


Extremely rare European X-Ray tube made from Bohemian crystal glass: This tube transmits UV as well as X-Rays

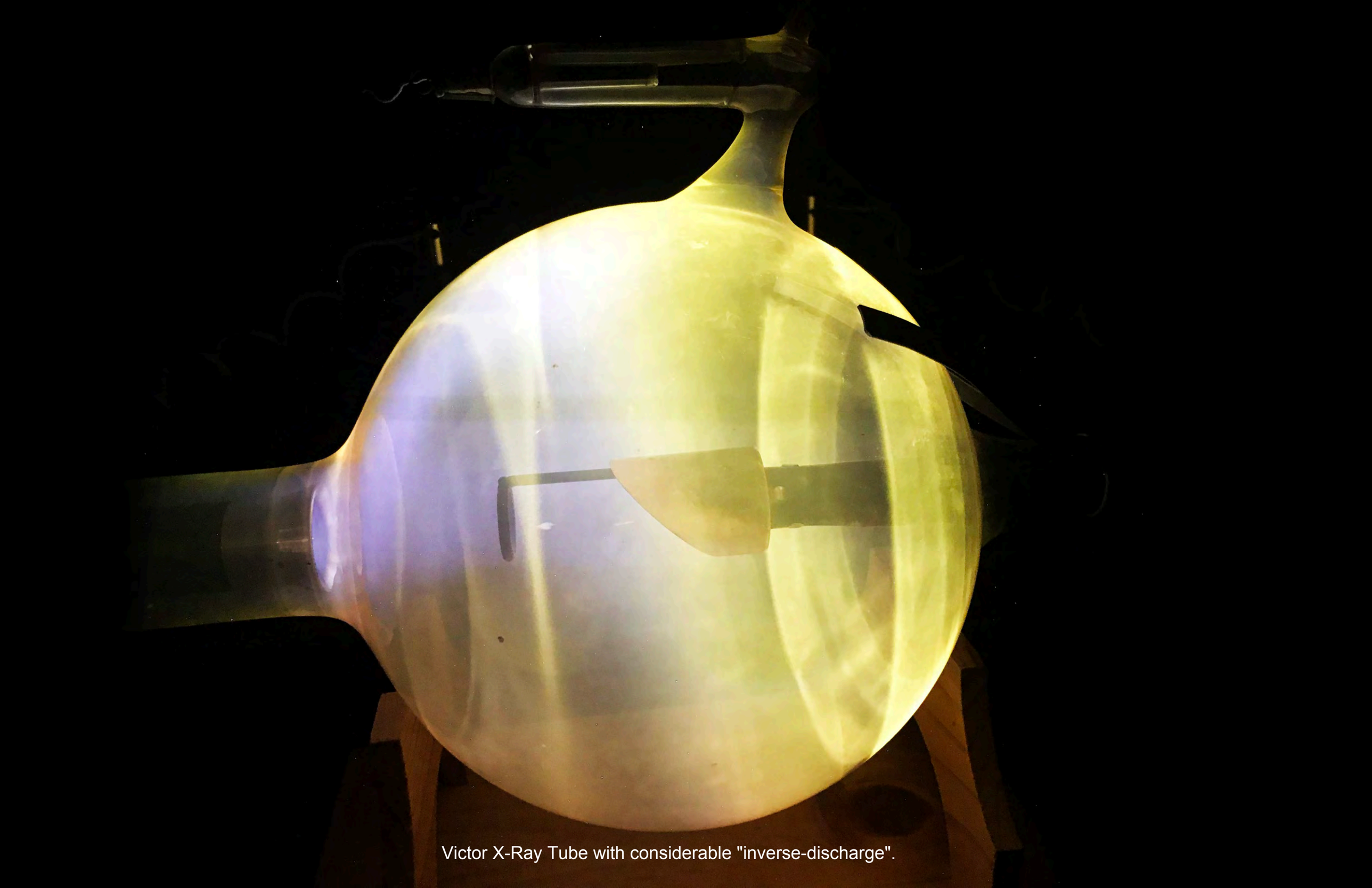


MacAlaster & Wiggin Early American X-Ray Tube. Violet discharge indicates vacuum has become to low for producing X-Rays

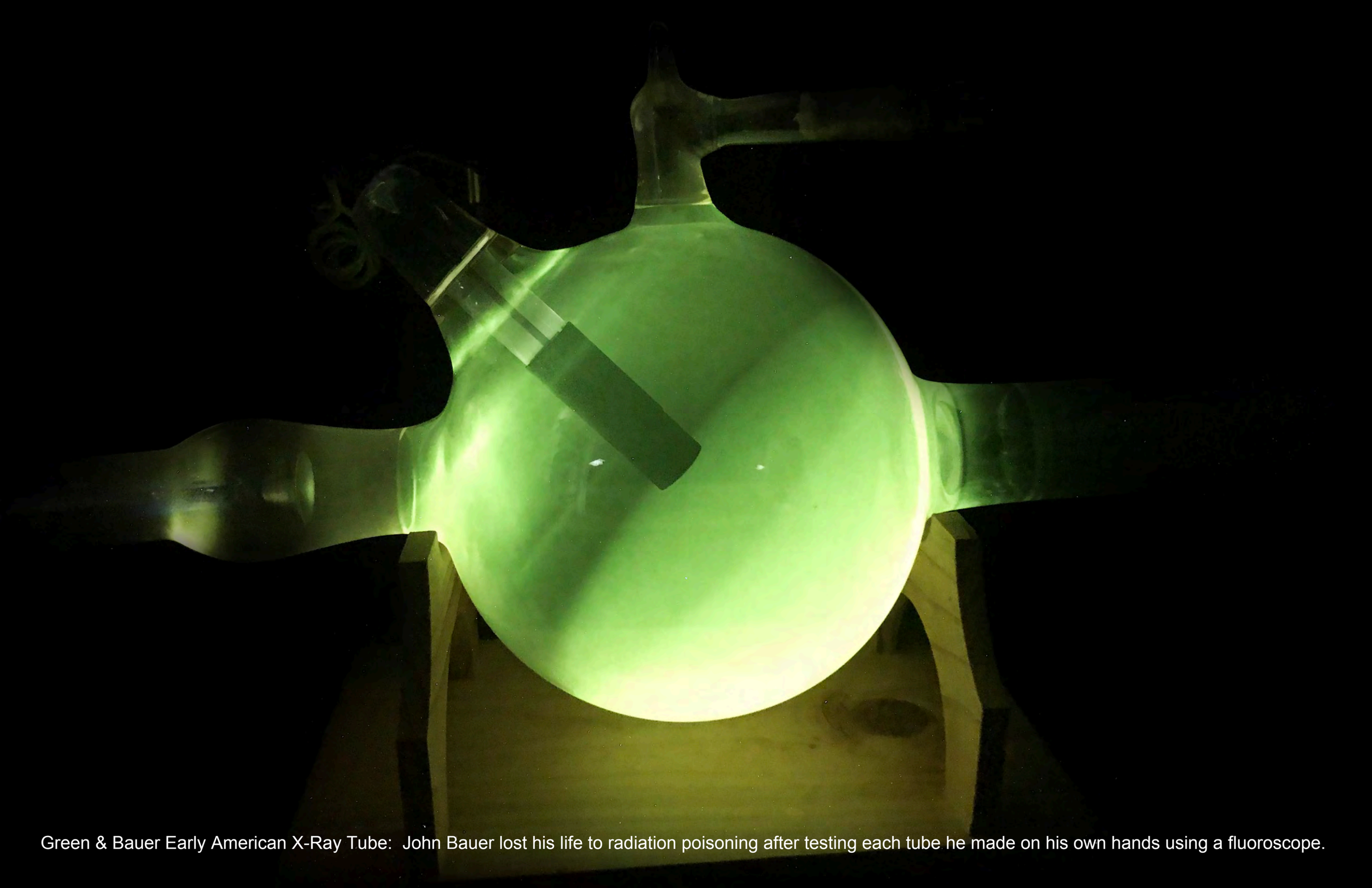
MacAlaster & Wiggin Early American X-Ray Tube: Purposely operated with poles reversed in this photo to demonstrate "inverse-discharge" where X-Rays are accelerated backwards through a tube instead of perpendicular from the tungsten target.



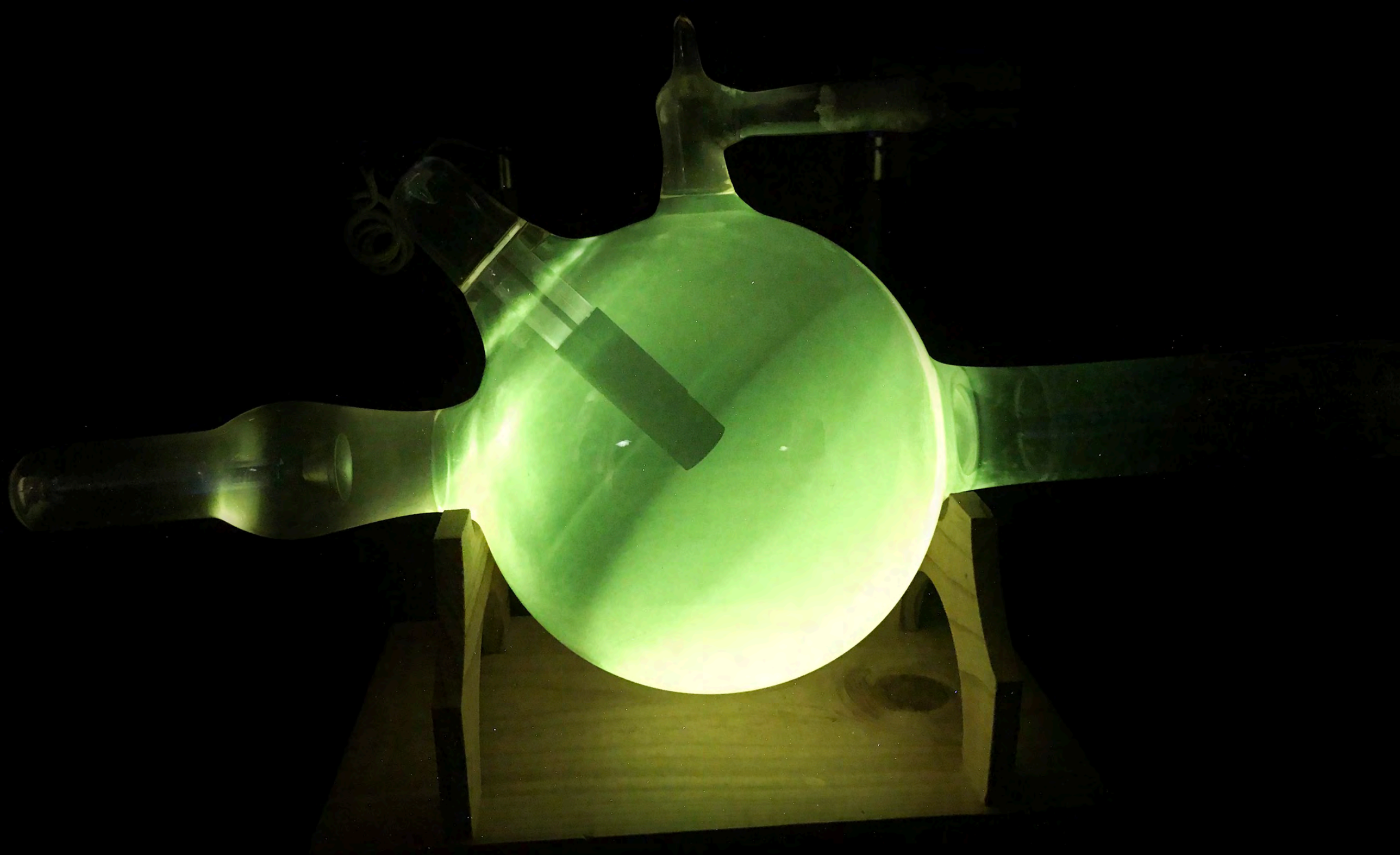
Victor X-Ray Tube with "ring" to help focus rays upon the tungsten target



Victor X-Ray Tube with considerable "inverse-discharge".



Green & Bauer Early American X-Ray Tube: John Bauer lost his life to radiation poisoning after testing each tube he made on his own hands using a fluoroscope.



Green & Bauer Early American X-Ray Tube: Henry Green, in order to honor his partner, died the same way several years later (despite knowing the dangers.)

Collection of vacuum discharge tubes made by Jeff Behary

Fluoroscopic view of a collector's hand, honoring the thousands of physicians and inventors who died pioneering the X-Ray tube.

This compilation is dedicated to Frank Jones, my partner in crime for many years.

To Lutz Neumann, who continues to make tubes in Cursdorf, Germany.

And Wolfgang Linschmann, who worked in the Rudolf Pressler factory.