

# Tesla Coil Digital Photography Project

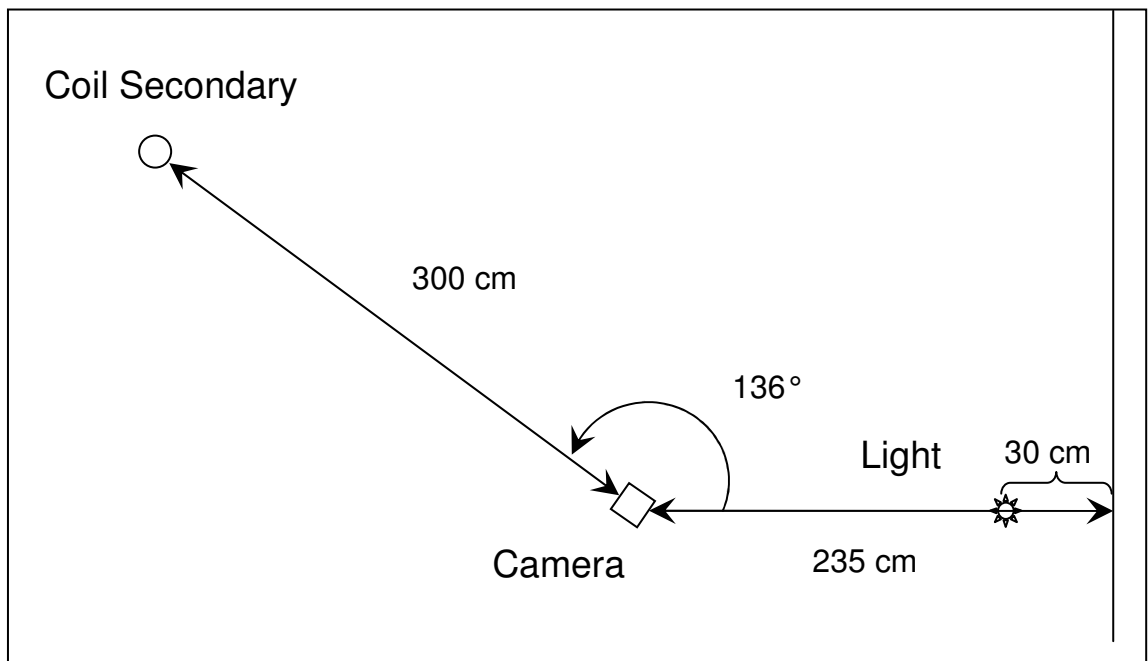
Mike Strube



The purpose of this project was to explore the influence of different camera settings on the quality of digital photographs taken of a Tesla coil. A Sony Cyber-shot digital camera was used with its manual settings, allowing independent adjustment of “film speed,” aperture, and shutter speed. Photographs were taken under dark and low light conditions, with no post-processing of the images beyond reduction to manage file size or cropping to isolate parts of the images.

### Camera and Setting Specifications

- Sony Cyber-shot DSC-S75, 3.3 megapixels
- Fine (rather than standard) setting
- Focal length 9 mm
- ISO (100 or 400), aperture (13 settings between f2.1 and f8.0), and shutter speed (10 settings between 1 and 8 s) set independently; all combinations tested.
- Automatic white Balance
- Resolution: 1200 x 1600 pixels
- Images saved in JPG format
- Dark setting photographs were taken in a completely dark room, with the only light provided by the coil. Low light photographs were taken with indirect light provided by a 100 W shop light (height = 210 cm) directed at a paneled wall. The following diagram shows the location of the light relative to the coil and camera:



- In the low light setting, the illuminance measured at the secondary (at camera height of 150 cm) was 9 lux.

## Coil Specifications

### Primary

- 0.25" copper tubing
- 0.25" edge-to-edge spacing between turns
- 16.25 total turns
- Inner diameter = 6.5" (primary to secondary spacing of 1.0")
- Outside diameter = 22.5"
- Height from floor = 26.125"
- Tapped at 3.875 turns

### Strike Rail

- 0.25" copper tubing
- Diameter = 24.625"
- Height from floor = 29.25"

### Secondary

- Diameter = 4.5"
- Wound height = 28.0"
- H/D ratio = 6.21
- Wire = 22 AWG magnet wire, 1006 turns
- Measured inductance = 17.2 mH
- Measured DC resistance = 19.9  $\Omega$
- Self-capacitance = 10.45 pF

### Topload

- Spun aluminum
- Cord (minor) diameter = 6.0"
- Outside (major) diameter = 24.0"
- Topload height (centerline) = 31.125" from primary plane

### Tank Capacitor

- MMC Design
- Cornell Dubilier 0.15  $\mu$ F, 2000 V caps
- 11 caps per string, 6 strings that can be arranged in several series/parallel configurations. MMC configured for 81.8 nF.
- 10 M, 3500 V, bleeder resistors across each cap

### Power Supply

- 4-MOT supply (~8800 V and ~300 mA)
- 140  $\mu$ F power factor correction
- One secondary-shortened MOT used as ballast on the primary side
- Two 1  $\mu$ F MOT caps in series were used on each secondary leg
- Power was controlled using a 0-140 V variac, maximum used was 90 V

### Spark Gap

- Triggered spark gap design, vacuum fan quenched

### Safety Gap

- 0.125 tungsten carbide drill blanks mounted in brass stock and brass drawer knobs

### Filter

- Standard "Terry Fritz" design

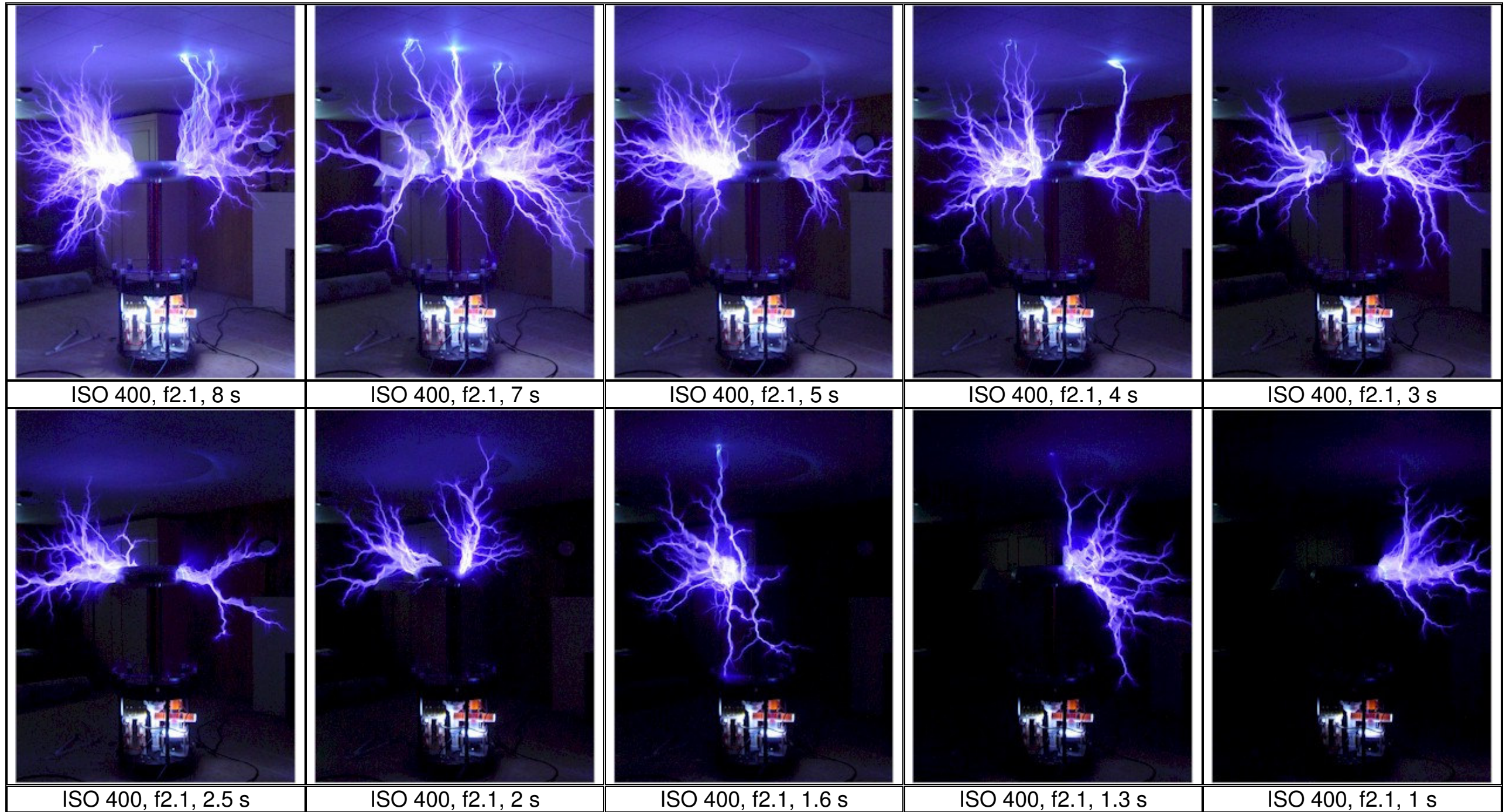
Additional information on this coil can be found at

<http://home.earthlink.net/~mjstrube/tesla.html>

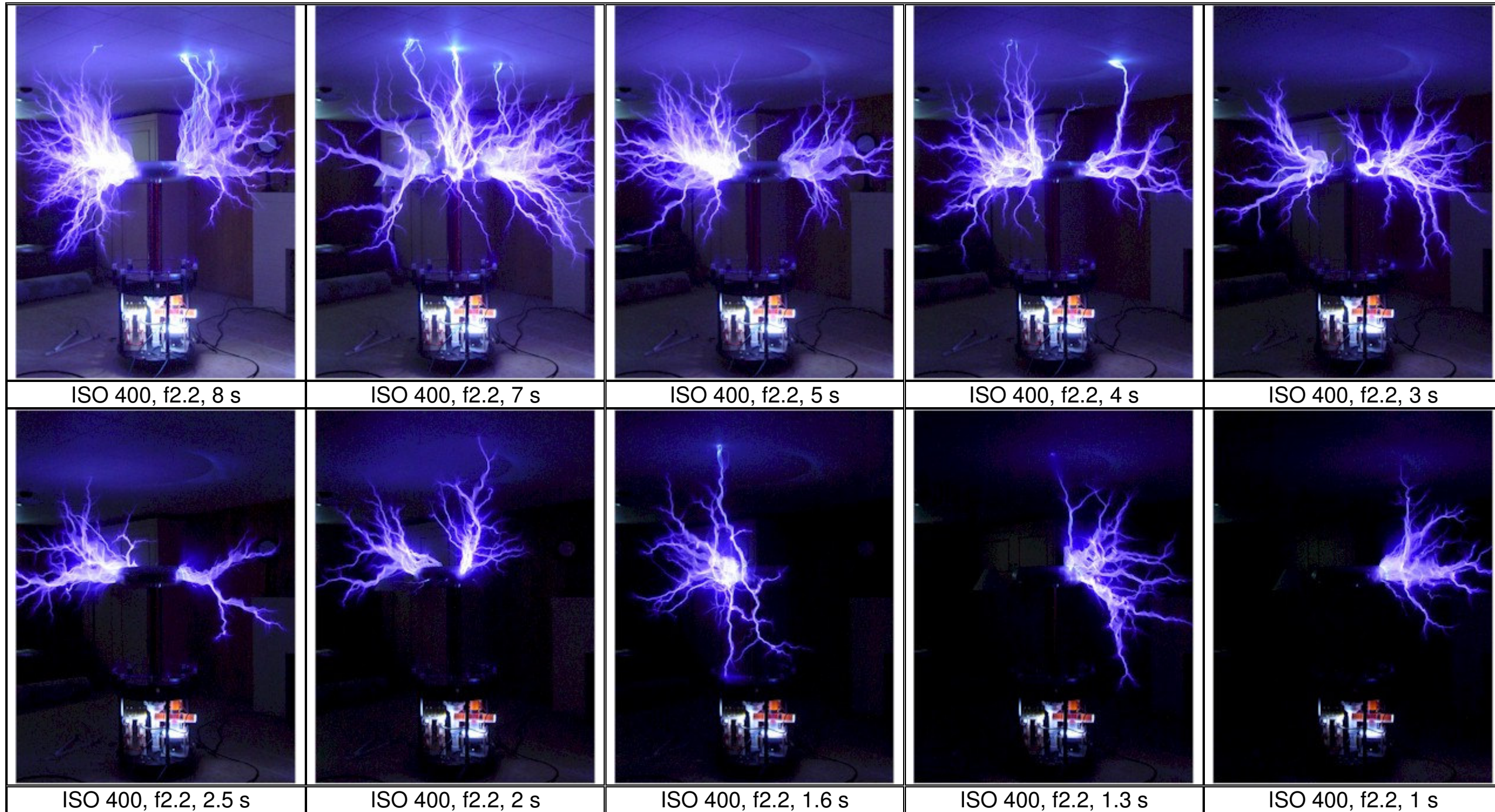
Results are organized in 9 files:

1. ISO 100, dark setting, full view photographs reduced to 20% of original size  
([TeslaPhotographyISO100Dark.pdf](#))
2. ISO 100, low light setting, full view photographs reduced to 20% of original size  
([TeslaPhotographyISO100Light.pdf](#))
3. ISO 400, dark setting, full view photographs reduced to 20% of original size  
([TeslaPhotographyISO400Dark.pdf](#))
4. ISO 400, low light setting, full view photographs reduced to 20% of original size  
([TeslaPhotographyISO400Light.pdf](#))
5. ISO 100, dark setting, cropped images at full resolution to show graininess  
([TeslaPhotographyISO100DarkGrain.pdf](#))
6. ISO 100, low light setting, cropped images at full resolution to show graininess  
([TeslaPhotographyISO100LightGrain.pdf](#))
7. ISO 400, dark setting, cropped images at full resolution to show graininess  
([TeslaPhotographyISO400DarkGrain.pdf](#))
8. ISO 400, low light setting, cropped images at full resolution to show graininess  
([TeslaPhotographyISO400LightGrain.pdf](#))
9. Comparison of digital camera photographs with digitized photographs from a Canon AE-1 35 mm SLR camera (with a 50 mm lens) using matching film, aperture, and shutter speed settings (not all digital camera settings were available on the SLR camera)  
([TeslaCoilPhotographyDigitalAnalogComparison.pdf](#))

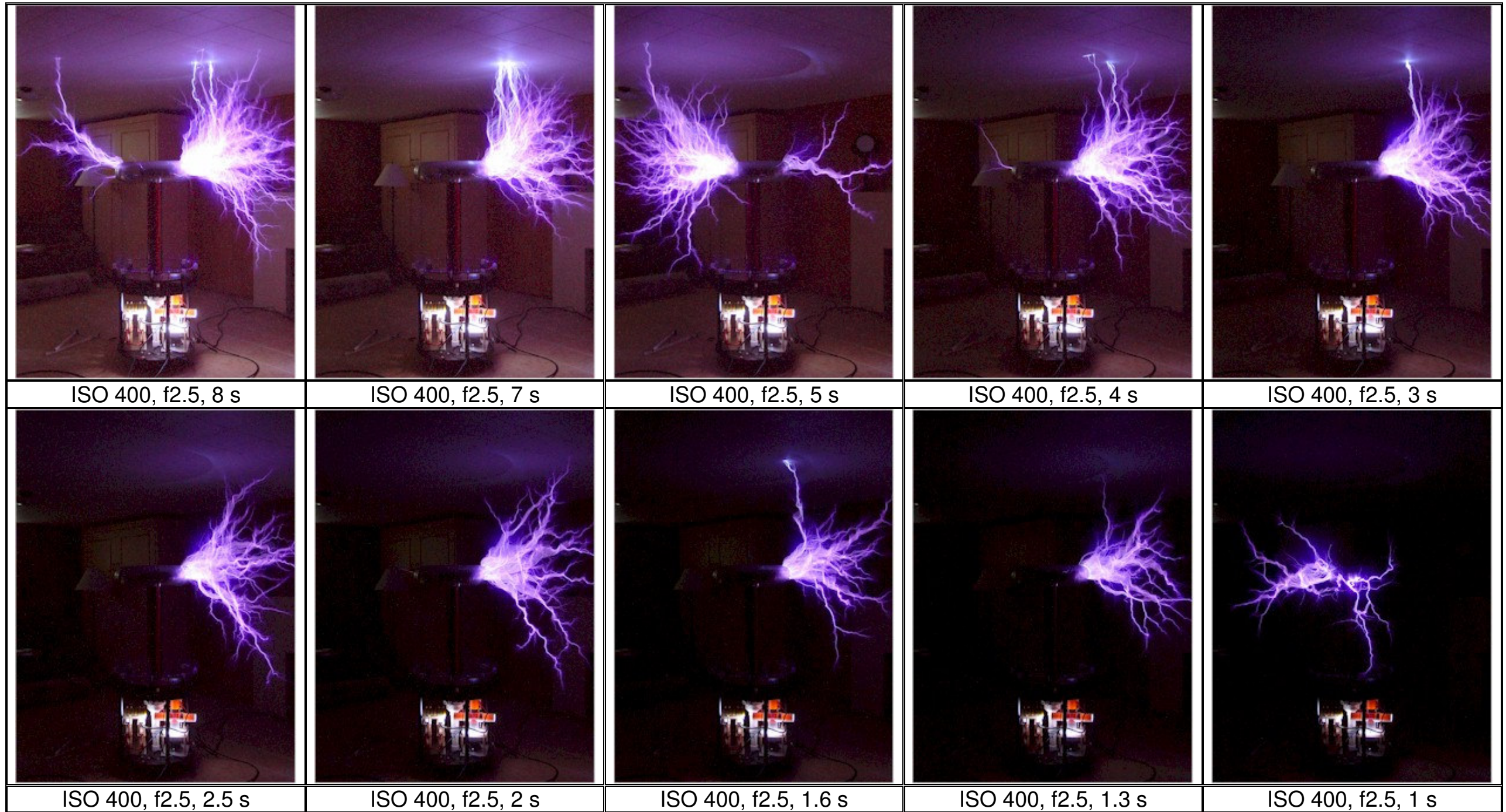




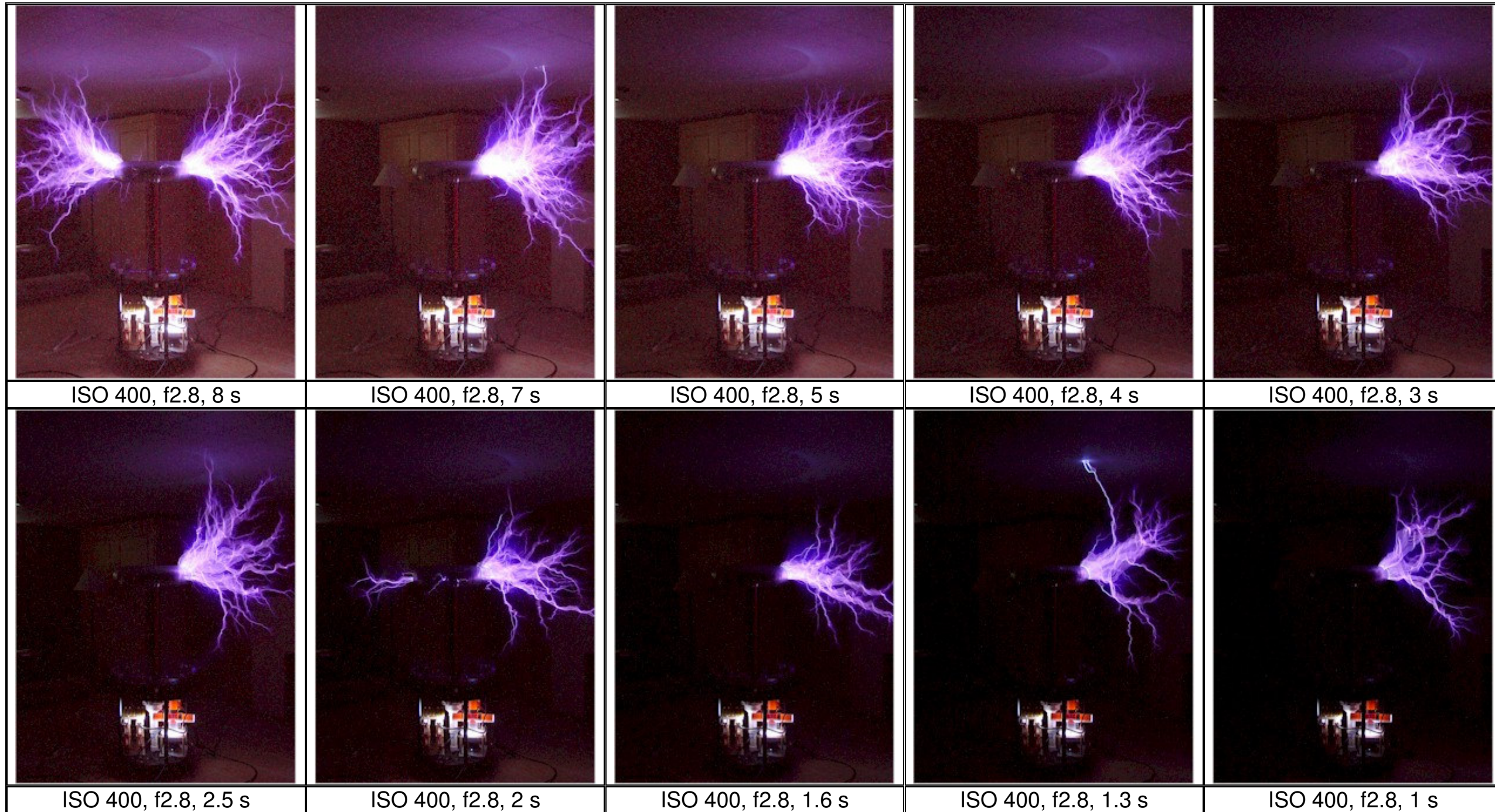




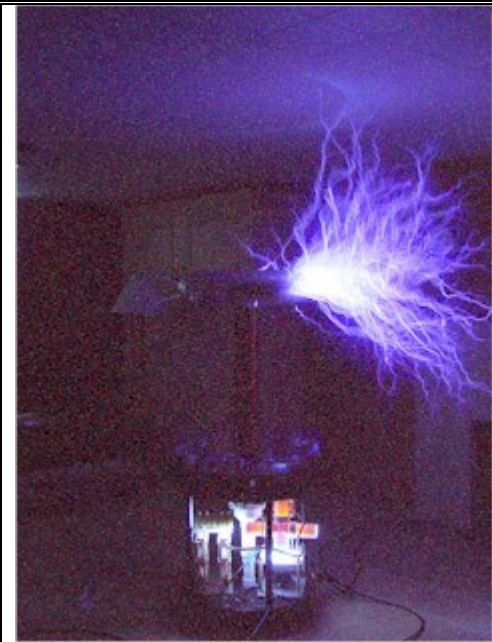




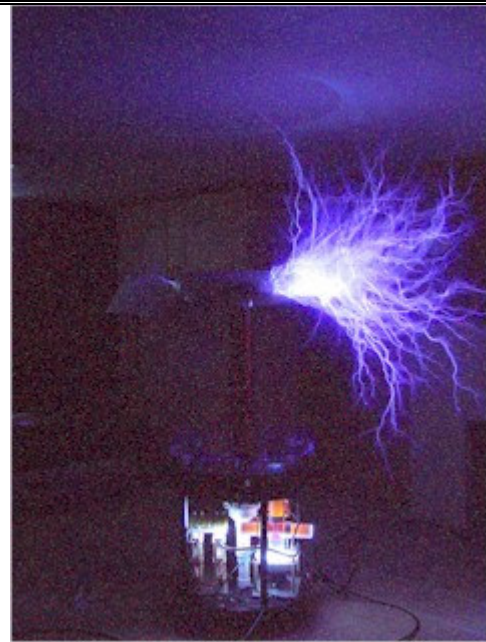




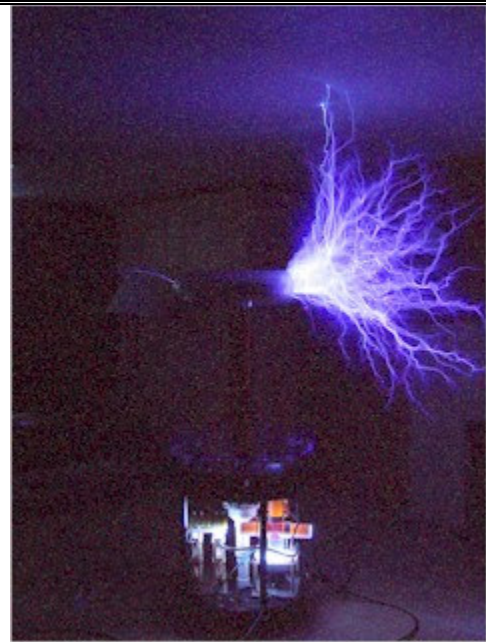




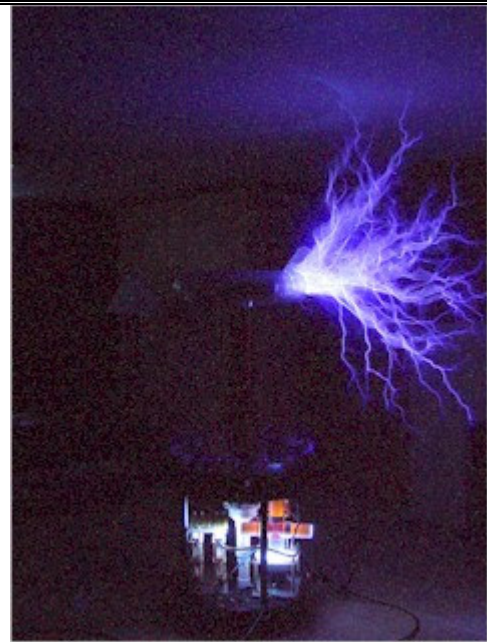
ISO 400, f3.2, 8 s



ISO 400, f3.2, 7 s



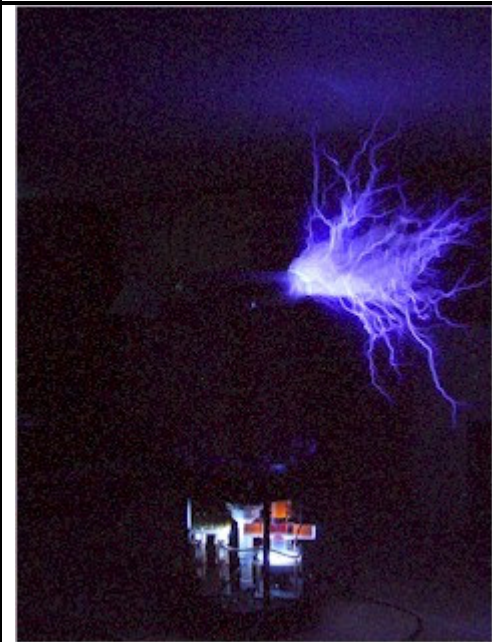
ISO 400, f3.2, 5 s



ISO 400, f3.2, 4 s



ISO 400, f3.2, 3 s



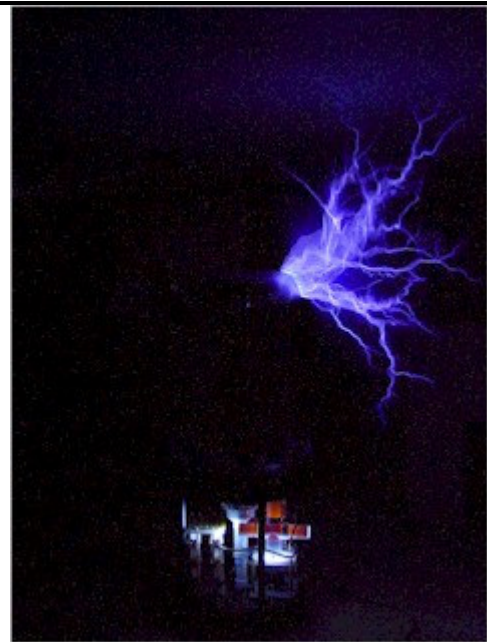
ISO 400, f3.2, 2.5 s



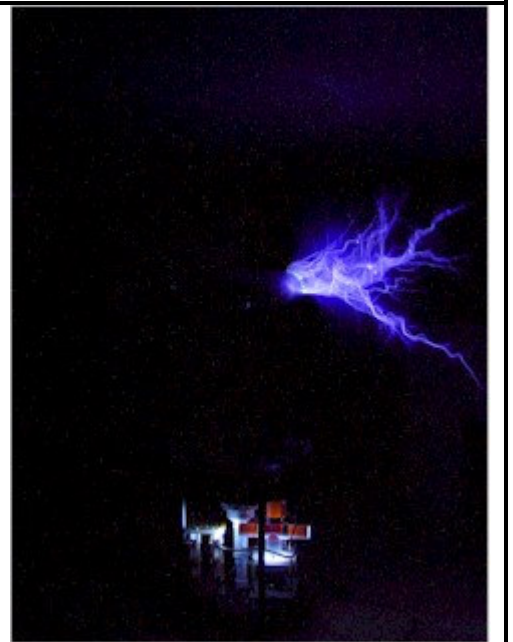
ISO 400, f3.2, 2 s



ISO 400, f3.2, 1.6 s

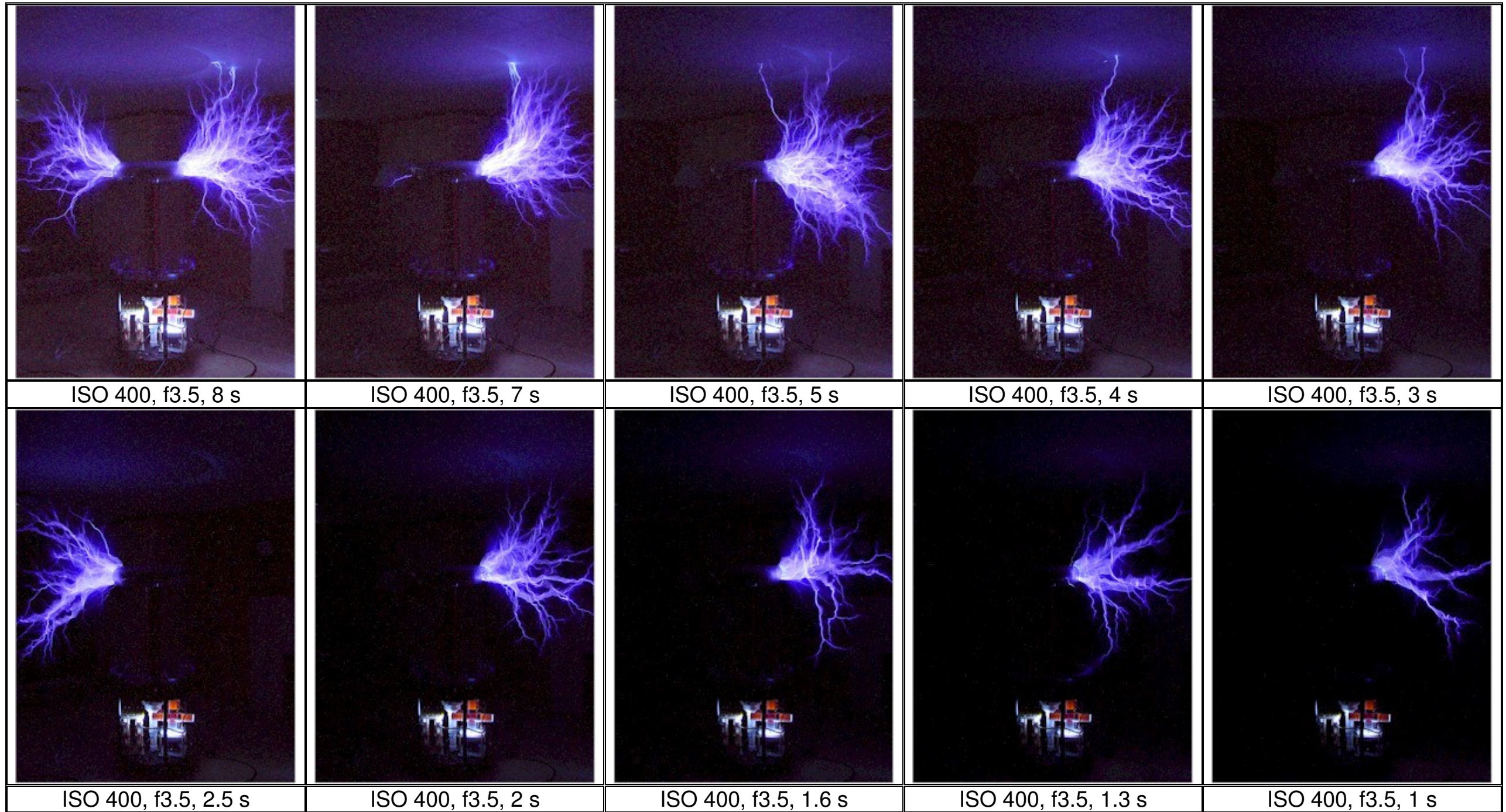


ISO 400, f3.2, 1.3 s

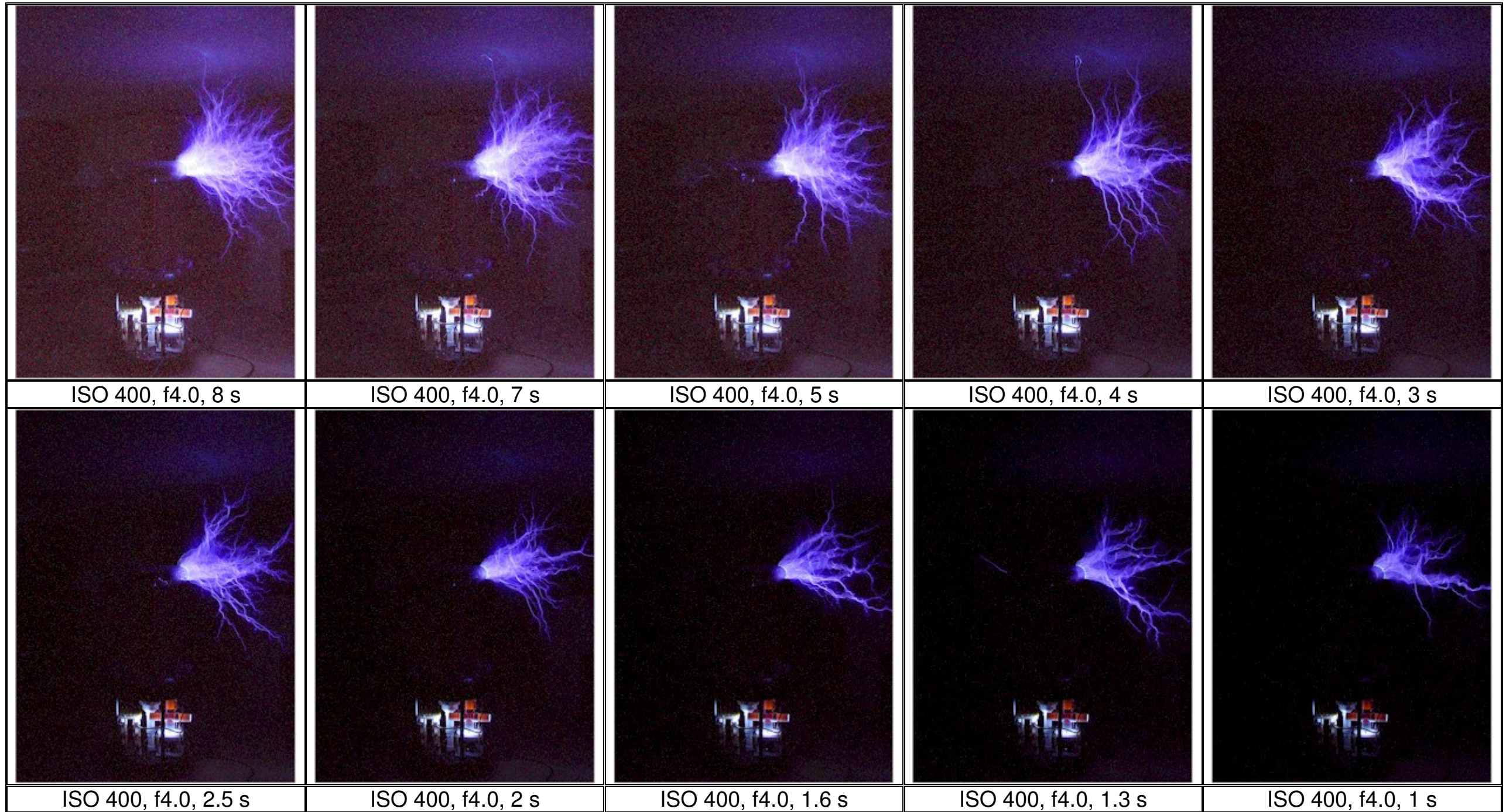


ISO 400, f3.2, 1 s

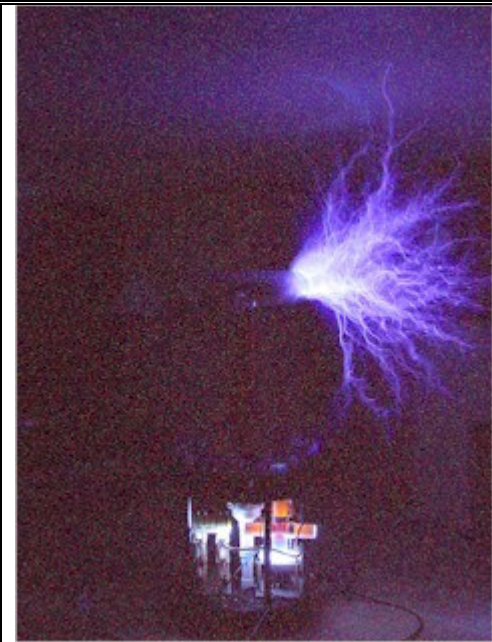












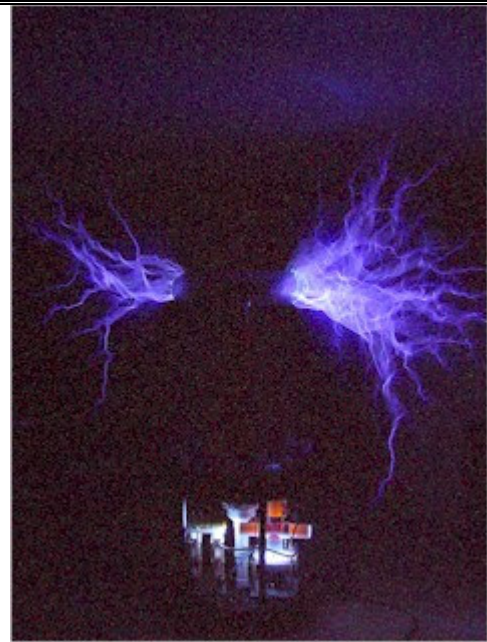
ISO 400, f4.5, 8 s



ISO 400, f4.5, 7 s



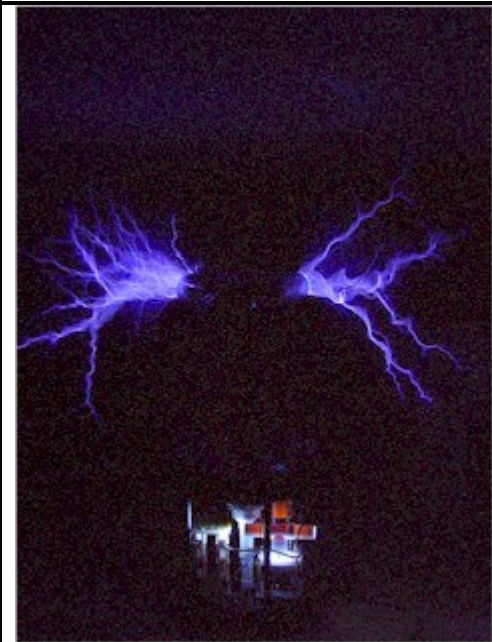
ISO 400, f4.5, 5 s



ISO 400, f4.5, 4 s



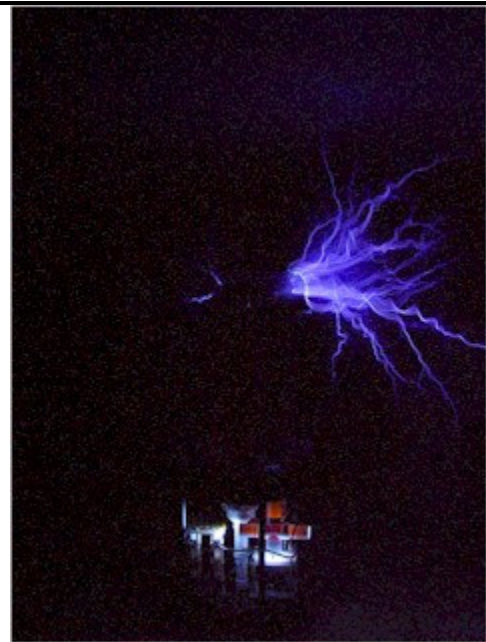
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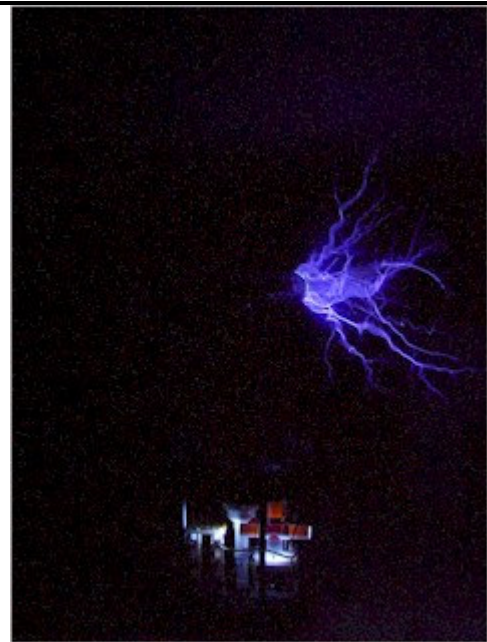
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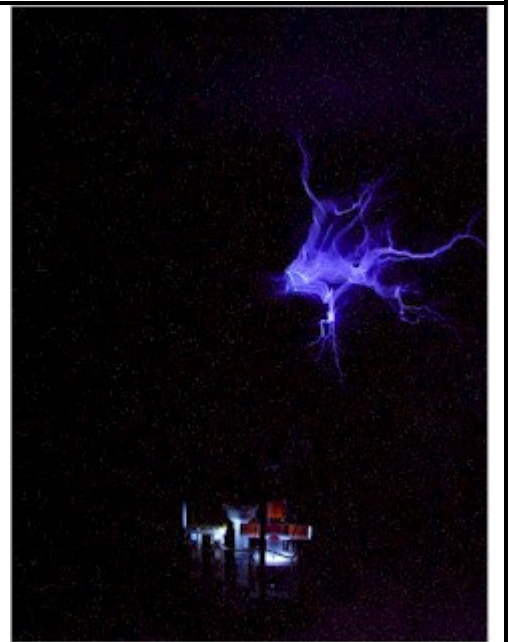
ISO 400, f4.5, 2 s



ISO 400, f4.5, 1.6 s

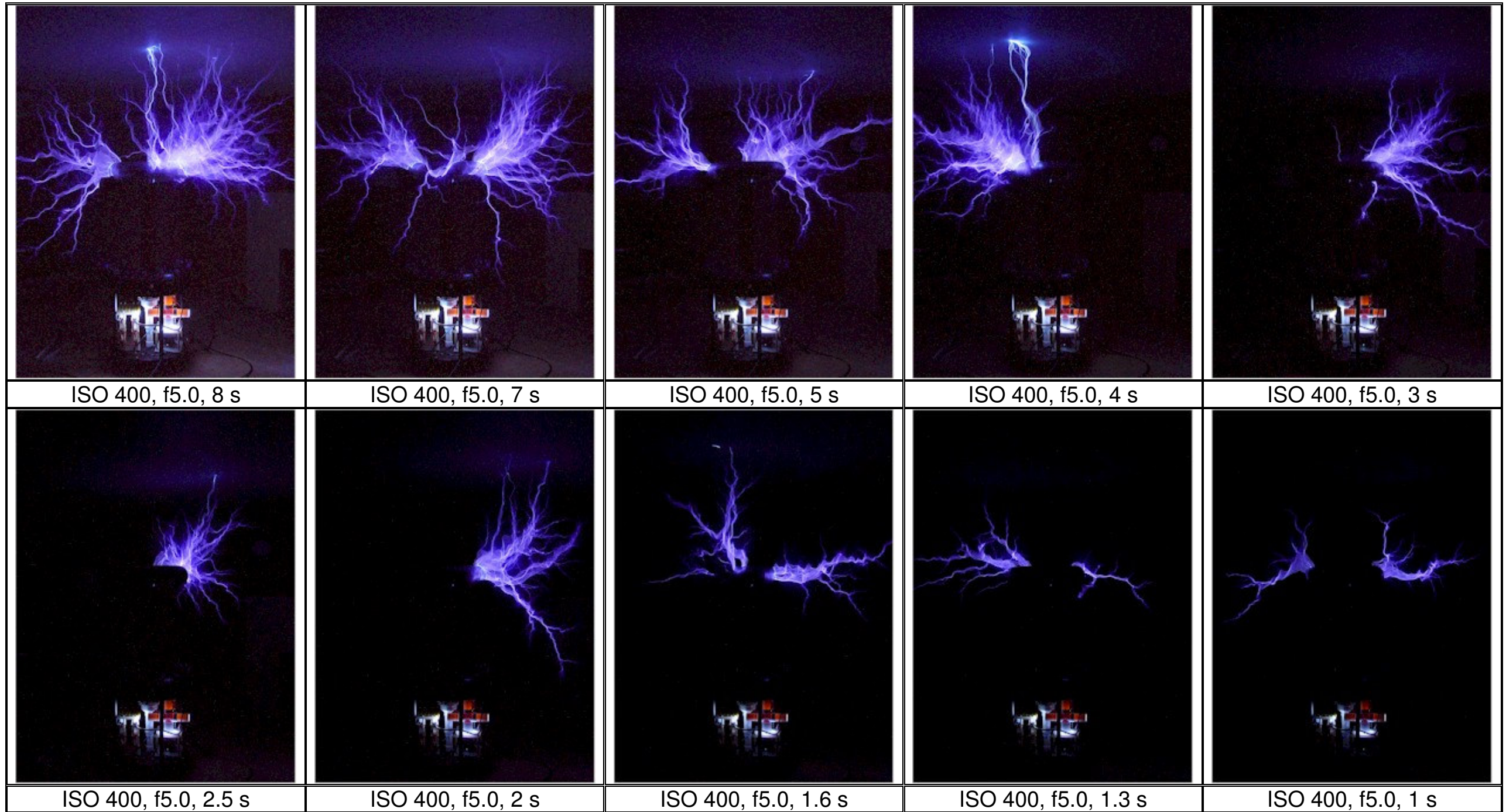


ISO 400, f4.5, 1.3 s

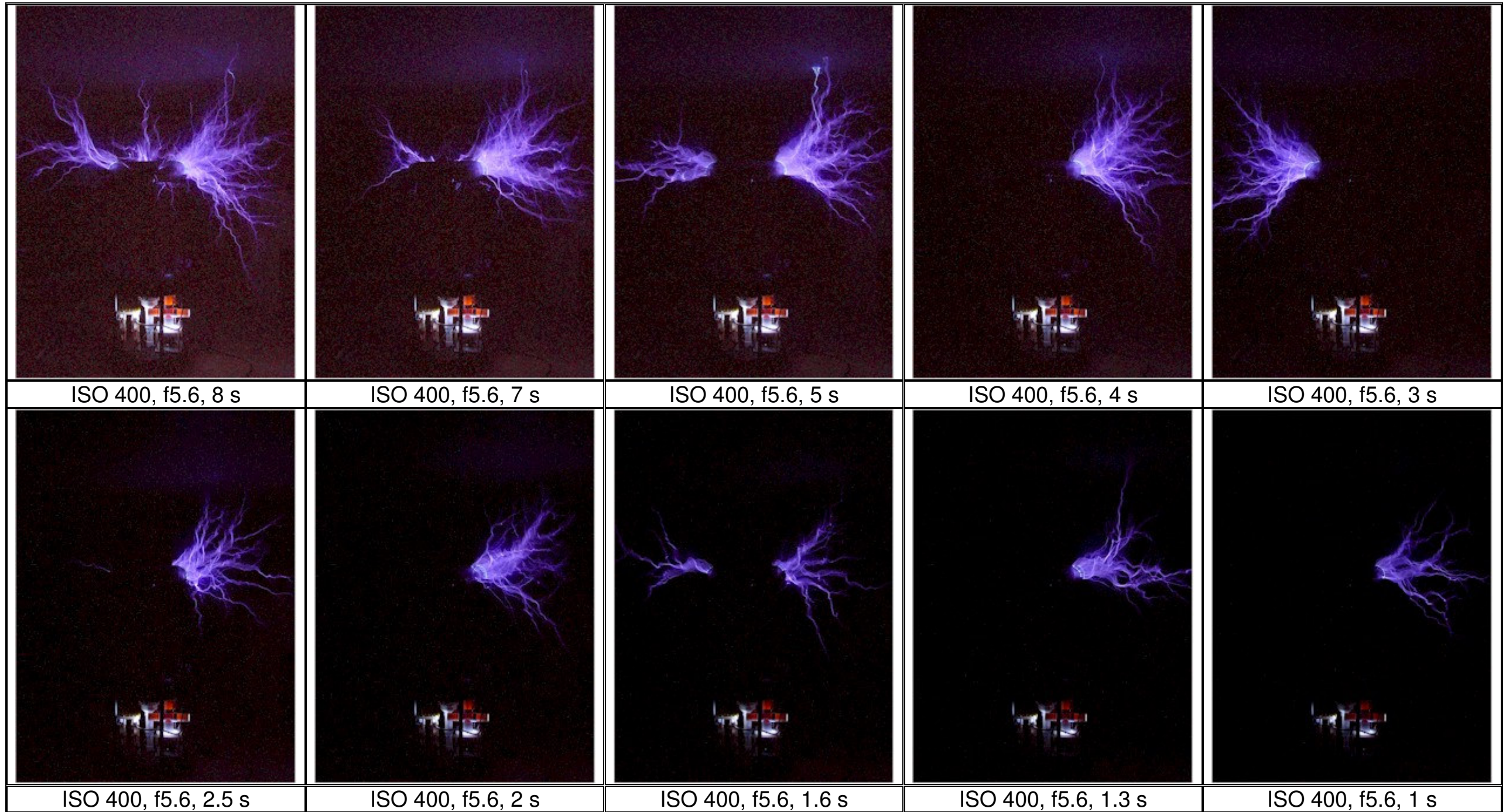


ISO 400, f4.5, 1 s

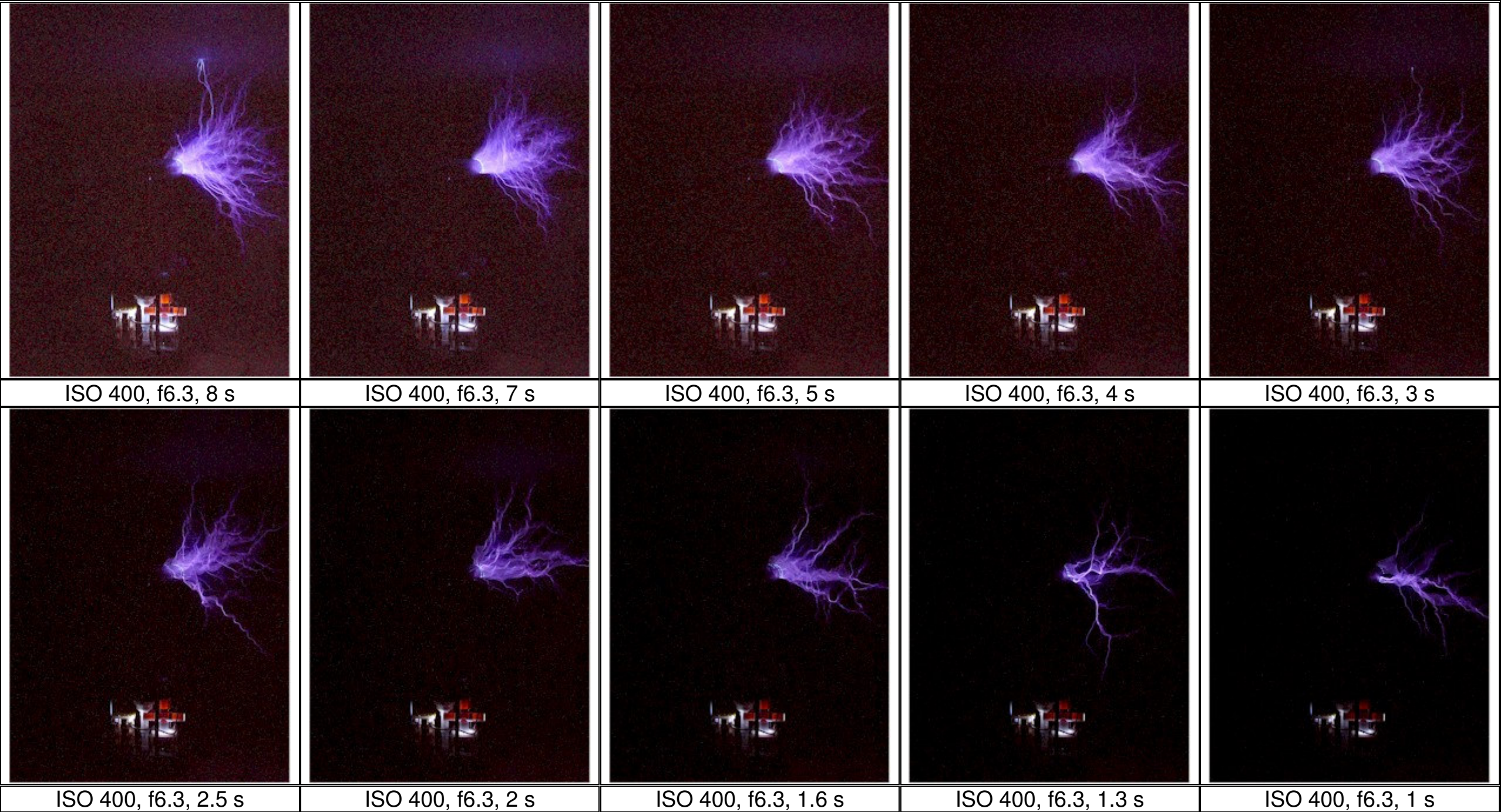












ISO 400, f6.3, 8 s

ISO 400, f6.3, 7 s

ISO 400, f6.3, 5 s

ISO 400, f6.3, 4 s

ISO 400, f6.3, 3 s

ISO 400, f6.3, 2.5 s

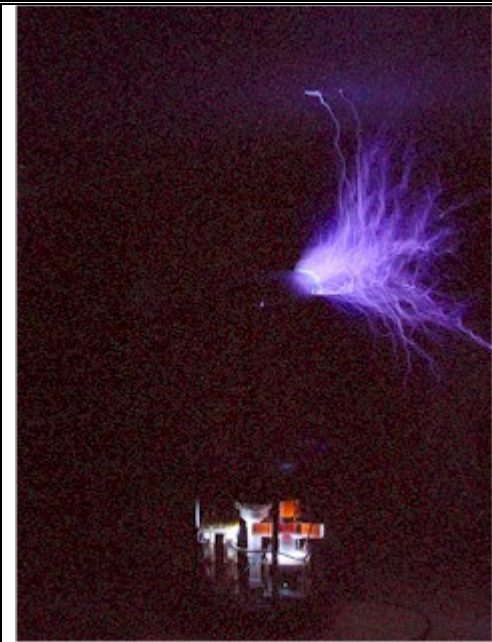
ISO 400, f6.3, 2 s

ISO 400, f6.3, 1.6 s

ISO 400, f6.3, 1.3 s

ISO 400, f6.3, 1 s





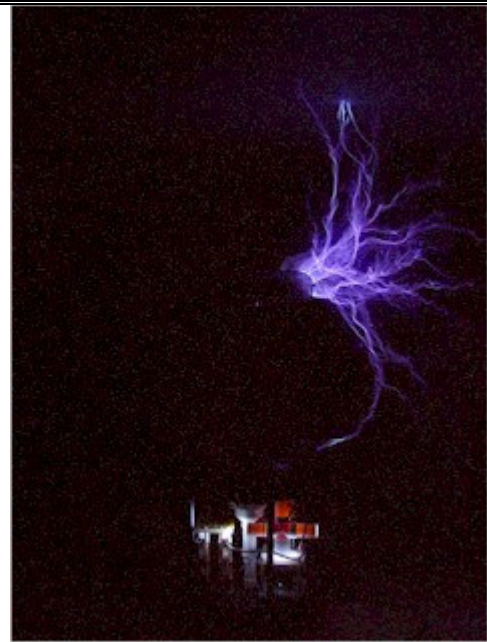
ISO 400, f7.1, 8 s



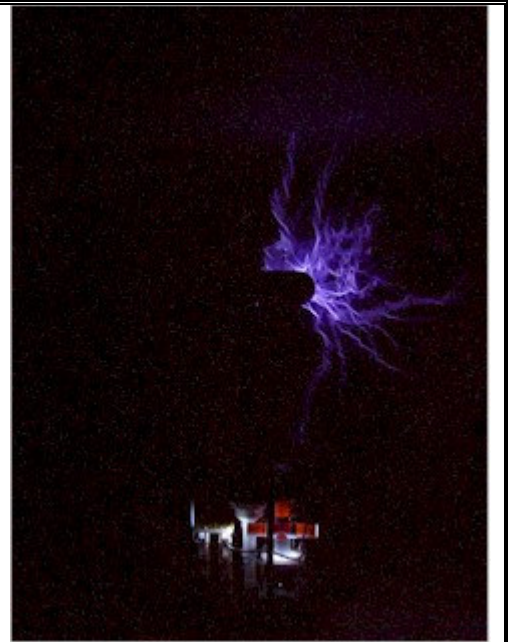
ISO 400, f7.1, 7 s



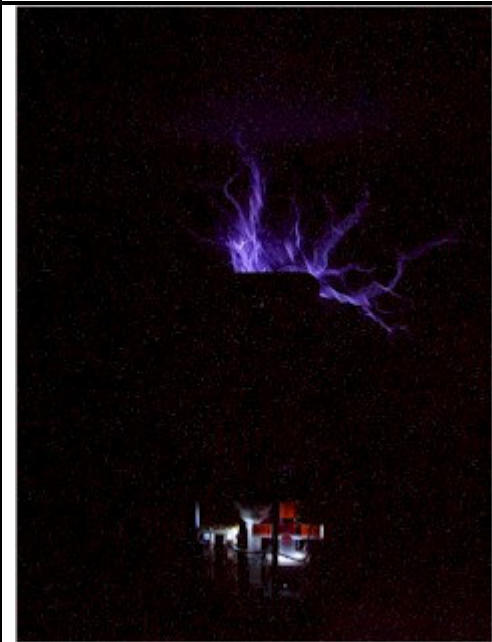
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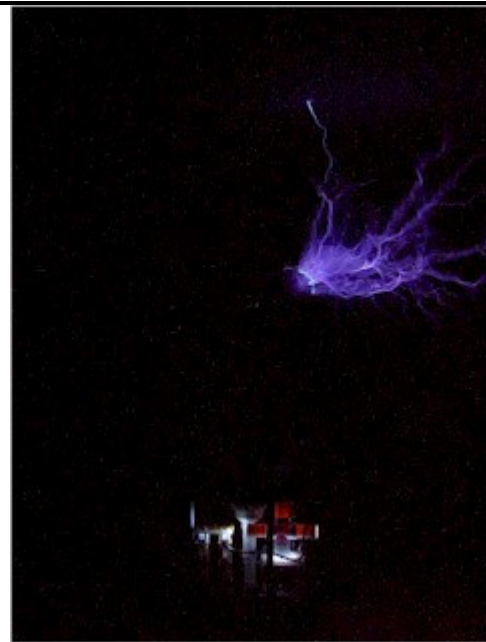
ISO 400, f7.1, 4 s



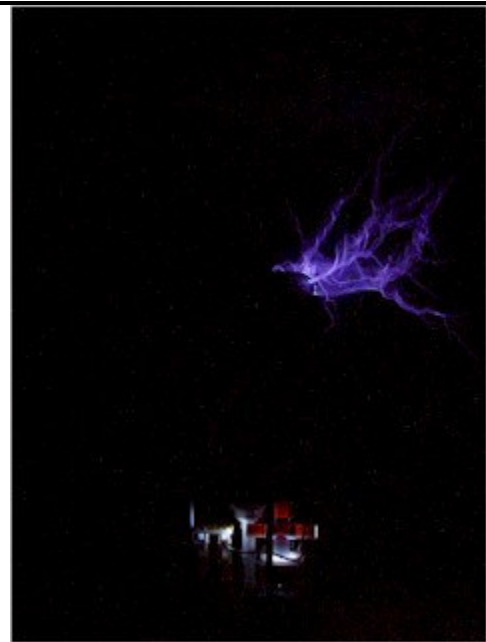
ISO 400, f7.1, 3 s



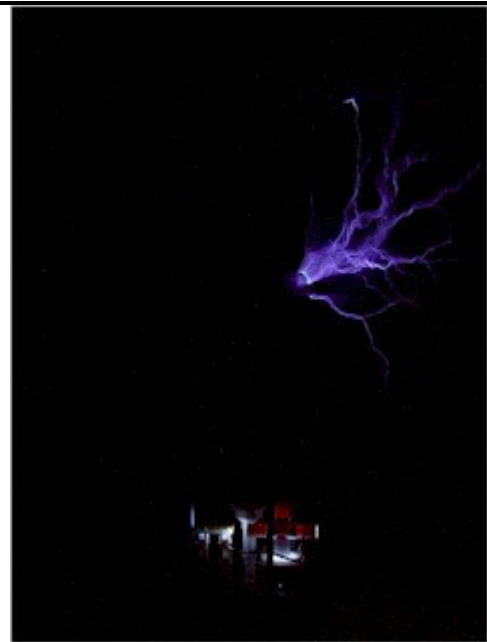
ISO 400, f7.1, 2.5 s



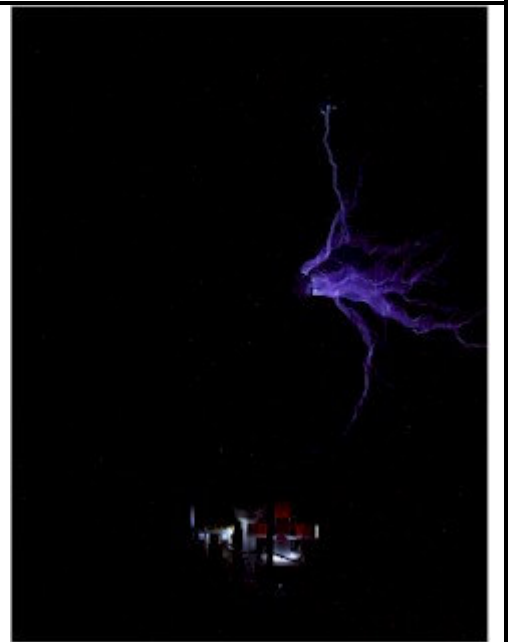
ISO 400, f7.1, 2 s



ISO 400, f7.1, 1.6 s

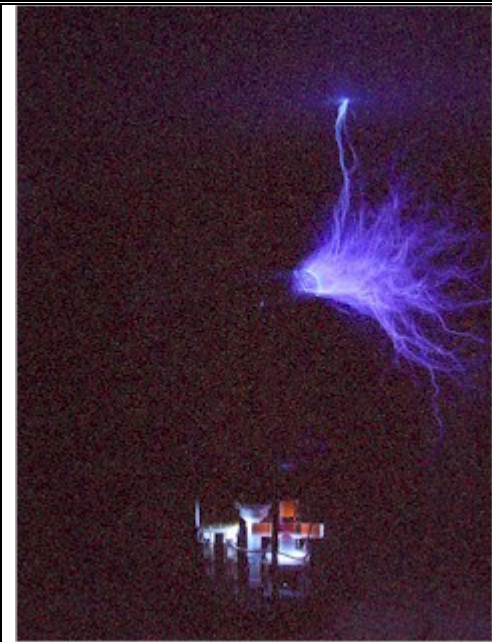


ISO 400, f7.1, 1.3 s



ISO 400, f7.1, 1 s





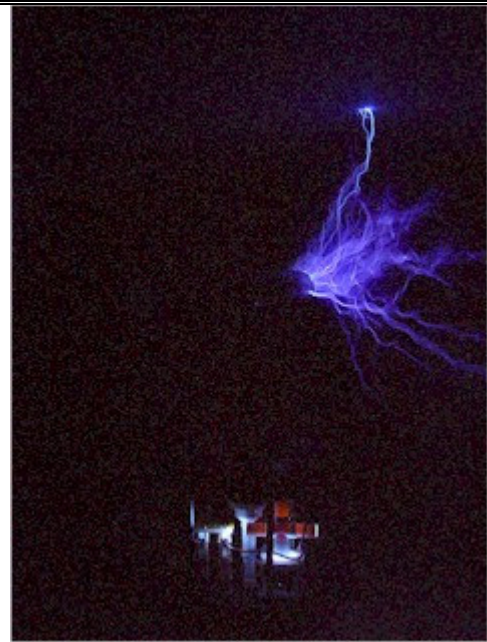
ISO 400, f8.0, 8 s



ISO 400, f8.0, 7 s



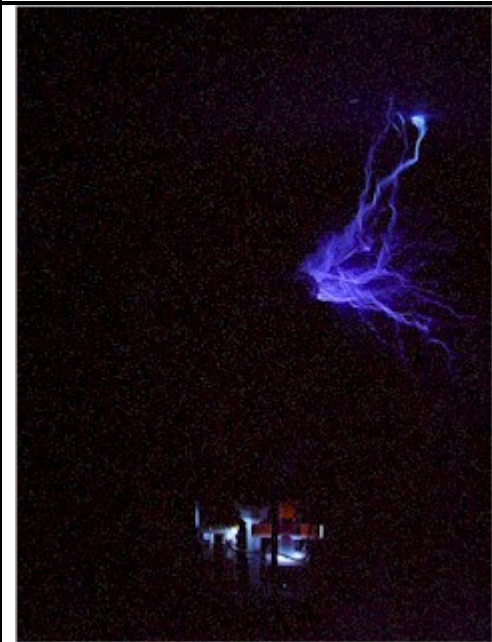
ISO 400, f8.0, 5 s



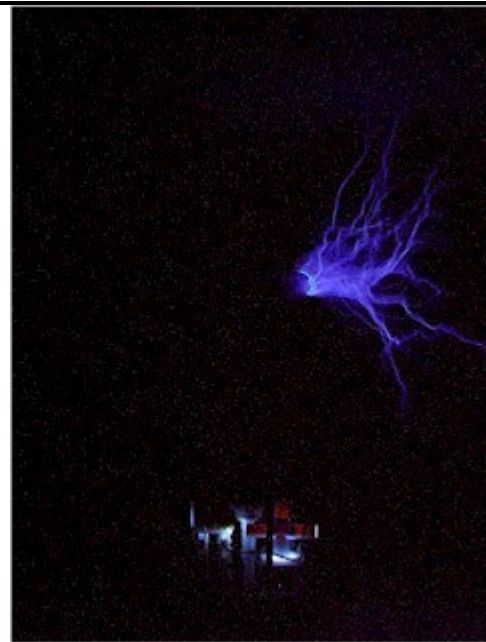
ISO 400, f8.0, 4 s



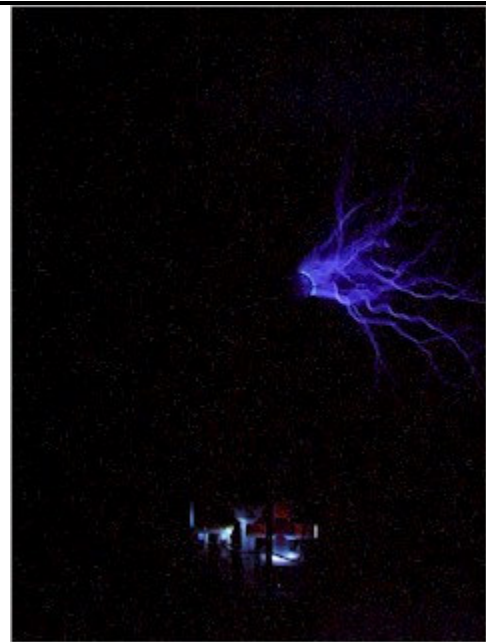
ISO 400, f8.0, 3 s



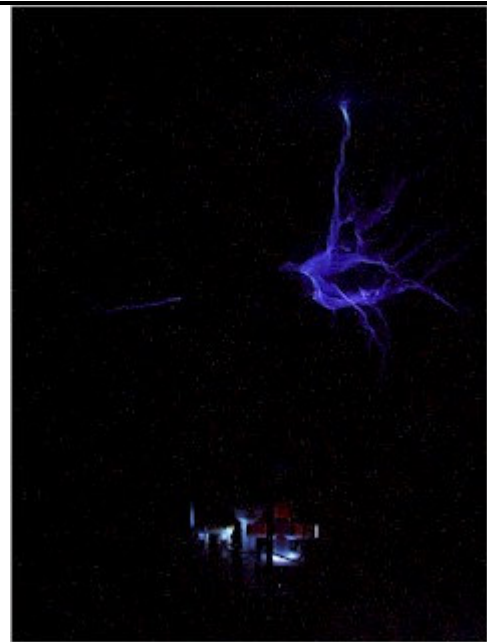
ISO 400, f8.0, 2.5 s



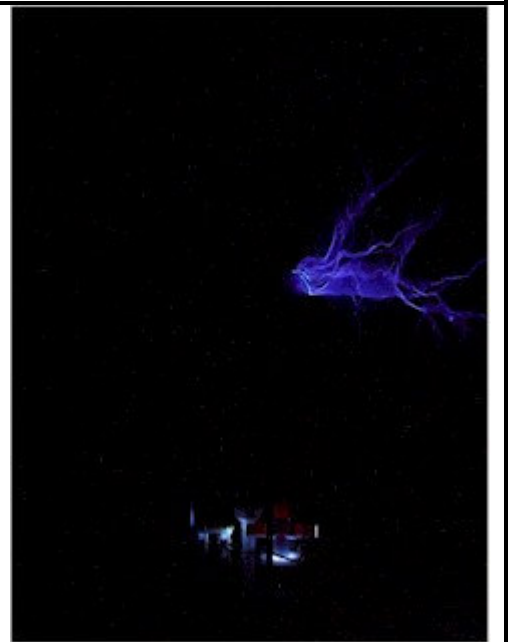
ISO 400, f8.0, 2 s



ISO 400, f8.0, 1.6 s



ISO 400, f8.0, 1.3 s



ISO 400, f8.0, 1 s