ALPhA Immersion
DC Glow Discharge Tube Parts & Suppliers
Spectrometers
Langmuir Probe Parts

Summary:

The DC Glow Discharge Setup has a basic configuration consisting of the vacuum system: vacuum tube, pressure sensor, pressure valve and vacuum pump, and of the electrical circuit: HV supply, current limiting resistor and electrodes.
This configuration can be used, as is, for the Paschen's Law experiment.

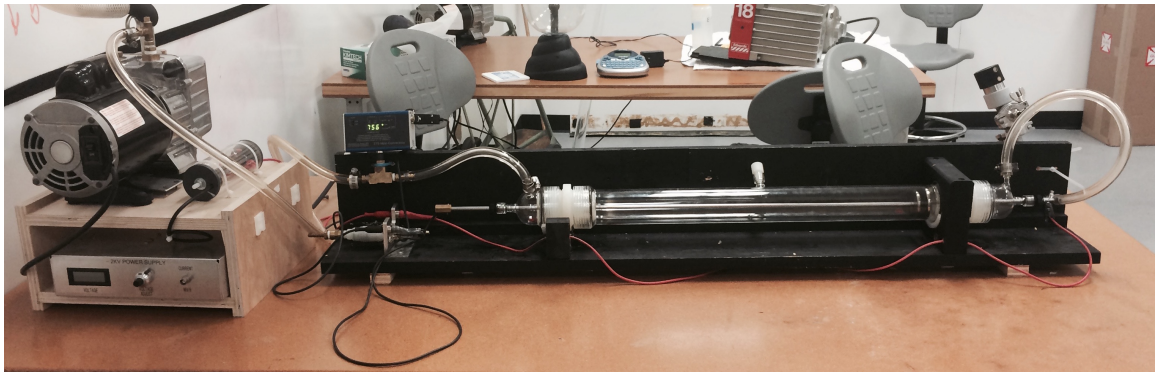
Cost: $3200-$4350 (depending on the pressure valve chosen)

Once this setup is completed, two more experiments can be easily conducted with the addition of supplemental diagnostics:
With the construction of Langmuir probes, density and temperature measurements can be conducted.
Cost:
Langmuir probe for DC discharge setup: $390
Independent experiment (doesn't require the DC setup): $370

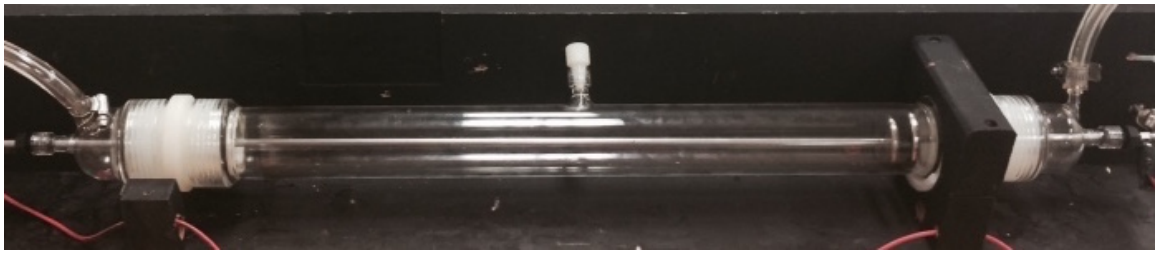
With the use of a visible range spectrometer and incorporating a gas tank inlet into the vacuum system (Argon gas has several usable lines in the visible), a Boltzman plot can be constructed to measure the temperature of the plasma.
Cost: $2000-$6000 (plus gas cylinder)

All costs are approximate and may change depending on availability.

DC GLOW DISCHARGE



Vacuum Tube:

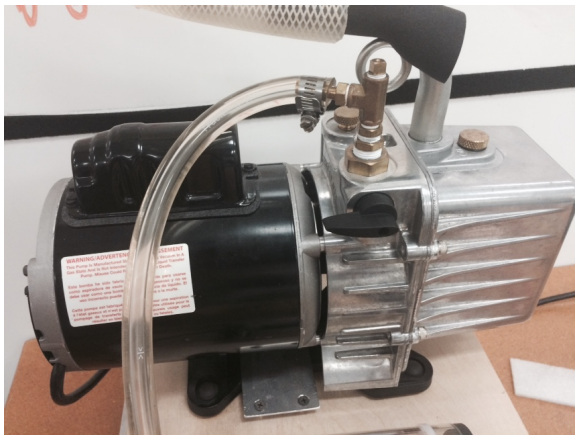


Ace Glass www.aceglass.com

Chromatography Column	#5820-55	$114.82
Adapter, Feedtube Septum	#5827-30	$113.75 (need 2)
Coupling	#5841-22	$106.40 (need 2)
Plastic Shield	#5798-62	$62.05
Nylon Bushing	#5029-10	$2.60 (if you need extras - 2 will come with adapters

(Note: If you want a glass column with extra port in center #7488-35-24-1 $258.13)

Vacuum Pump:



McMaster-Carr www.mcmaster.com
Part # 4396K43
Rotary Vane Deep Vacuum Pump $465.49

Vacuum Gauge:

www.helixtechnology.com
They sell a Granville Phillips Mini-Convectron Gauge controller and gauge.
Part # 275904-EU-T $551
Power supply for the gauge
275933 $55

Power Supply:

Ultravolt BT-GP-AC-2P30, AC powered 2kV max, positive polarity, 30 watts, $1365.

Limiting Resistor:

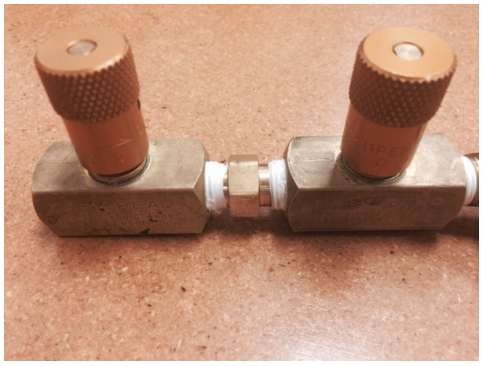
www.weisd.com TMC-50W-75K NTE Equvilent NTE 50WM375
$12

Needle Valves:

Here there are a few ways to go depending on price considerations. Below we've started from an inexpensive setup to a more expensive valve, but with more precise adjustments and more reproducible pressures:

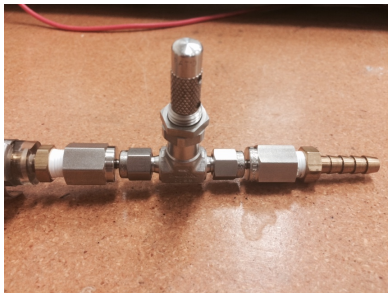
1st option:

Rough Adjust Valves:



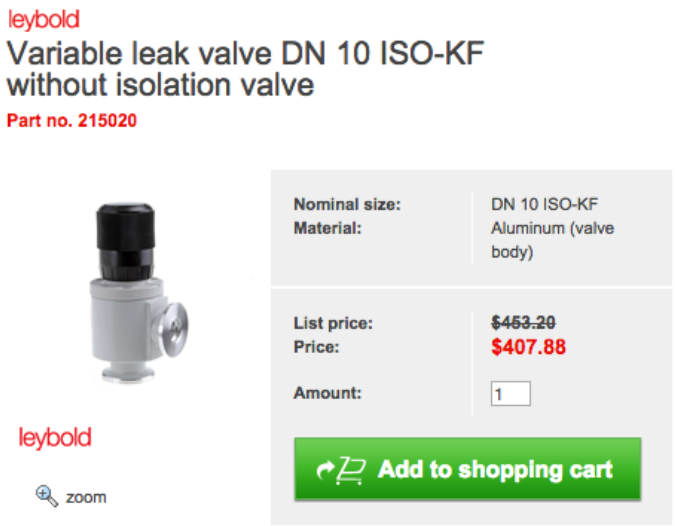
McMaster-Carr www.mcmaster.com
46425K12
$34.12
Easy-Set Needle Valve, Brass 1/4" NPTF

Fine Adjust Valve:



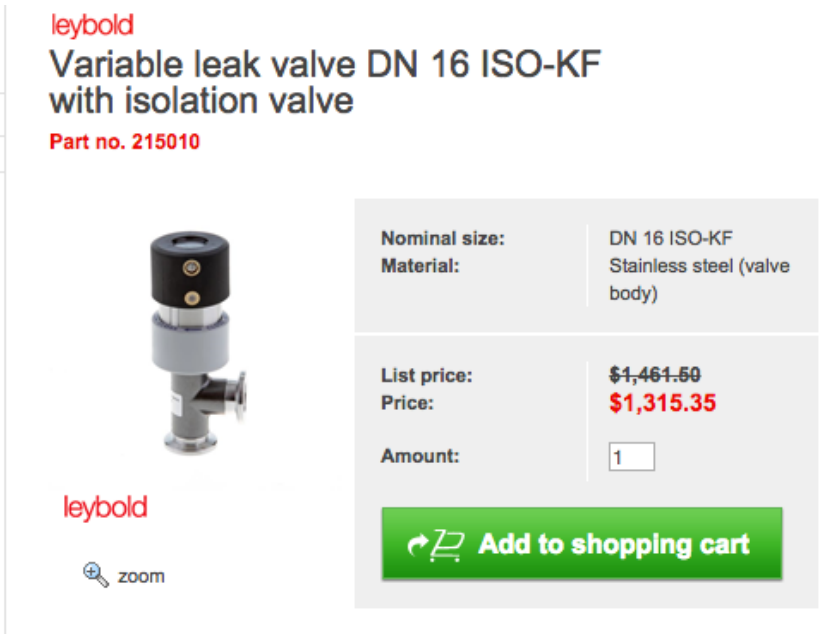
Swagelok www.swagelok.com
Part # B-SS4
$82
Brass Low-Flow Metering Valve, 1/4 in. Swagelok Tube Fitting

2nd option:
Leybold variable leak valve DV 10 ISO-KF without isolation:
Part number 215020
$407.88



another option (recommended for midrange cost) is to use this valve with a rough adjust valve (from option 1)

3rd option:
Leybold Variable leak valve DN 16 ISO-FK with isolation valve:
Part no 215010
$1315.35



This last option was the one being used in the last Alpha Immersion. It gives fine pressure control, but it may not be worth the price considering option 2

Hoses and clamps:

McMaster-Carr www.mcmaster.com
55505K38
Tygon R-3603 Tubing, 1/4” ID, 5/8” OD
$6.06/ft
Hose Clamps:
McMaster-Carr www.mcmaster.com
5388K17
Worm-Drive Hose Clamp W/Zinc Pltd Steel Screw $6.26/pkg.

Electrodes:

PPPL can provide electrodes on request. Dimensions are as follows:
Material: Stainless steel
Diameter: 1.9”
Thickness: 1/4”
Stainless rods: 1/4” diameter, grounded rod length = ~30” ; HV rod length: ~8”
Rods are threaded (you can also press fit) in the back of the disk

SPECTROSCOPY
There are several options for the spectrometers to use, we’ve used the following ones:

Low resolution: Vernier SpectroVis Plus	~$2000
Medium resolution: Ocean Optics USB 2000	~$3000
High Resolution: Ocean Optics HR 4000	~$6000

LANGMUIR PROBE
There are two setups for the Langmuir probe. One independent of the DC discharge described above and one that uses the setup. All of the details of the experiment and the parts to buy can be found in the Probes_handout.pdf in the Compadre site. The costs are below:
Self contained:
Oa4G bulb: ~$20 (ebay)
Power supply for discharge: ~$300 (ebay)
+/- 15V power supply for probe (International Power (part number IHAD15-0.4)): $47.66 at Mouser.com

Construction of probe for the DC setup (all parts from Kurt J. Lesker and McMaster-Carr): ~$390