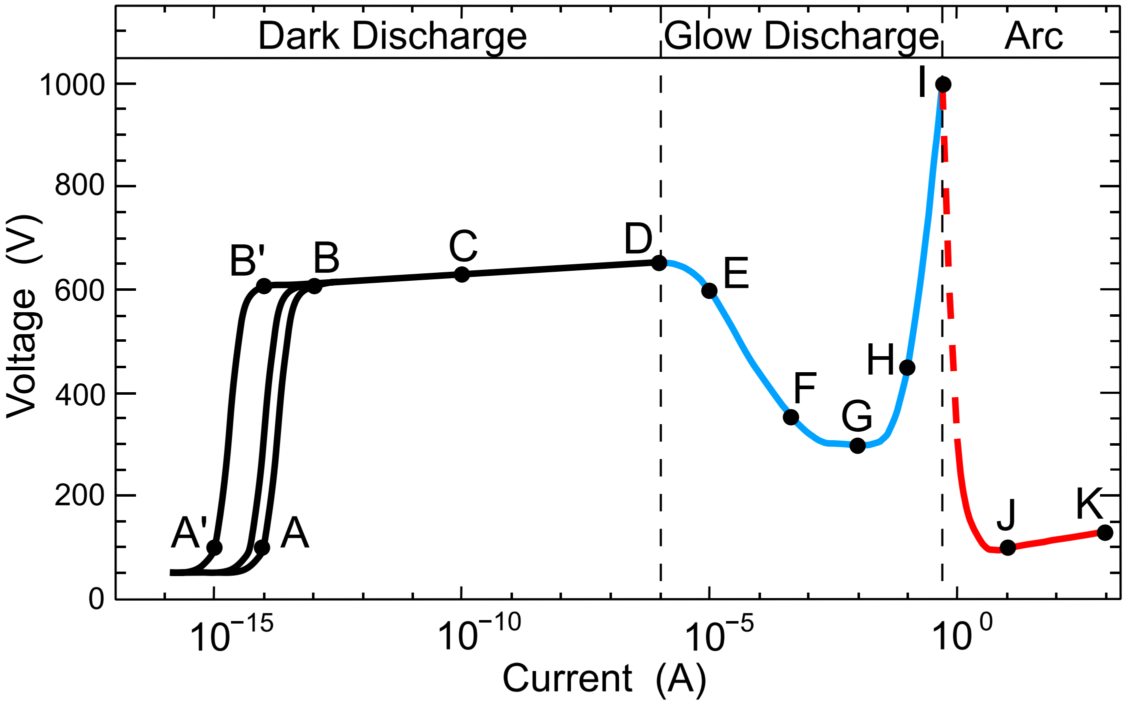


Voltage-current characteristics of electrical discharge in neon at 1 torr, with two planar electrodes separated by 50 cm.

A: random pulses by cosmic radiation

B: saturation current

C: avalanche Townsend discharge

D: self-sustained Townsend discharge

E: unstable region: corona discharge

F: sub-normal glow discharge

G: normal glow discharge

H: abnormal glow discharge

I: unstable region: glow-arc transition

J: electric arc

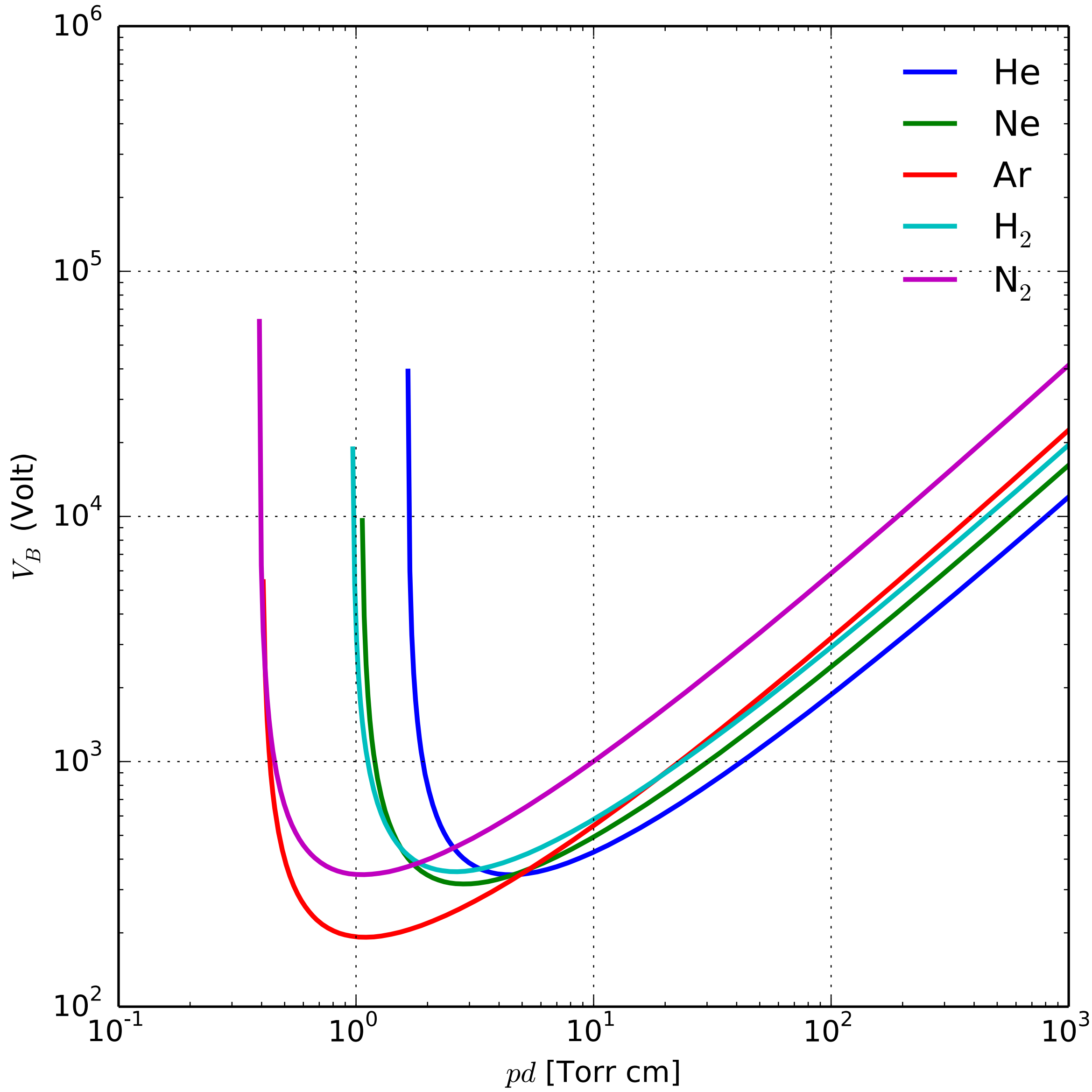
K: electric arc

A-D region: dark discharge; ionisation occurs, current below 10 microamps.

F-H region: glow discharge; the plasma emits a faint glow.

I-K region: arc discharge; large amounts of radiation produced.

$$\frac{I}{I_0} = \frac{e^{\alpha_n d}}{1 - \epsilon_i \left(e^{\alpha_n d} - 1\right)}$$

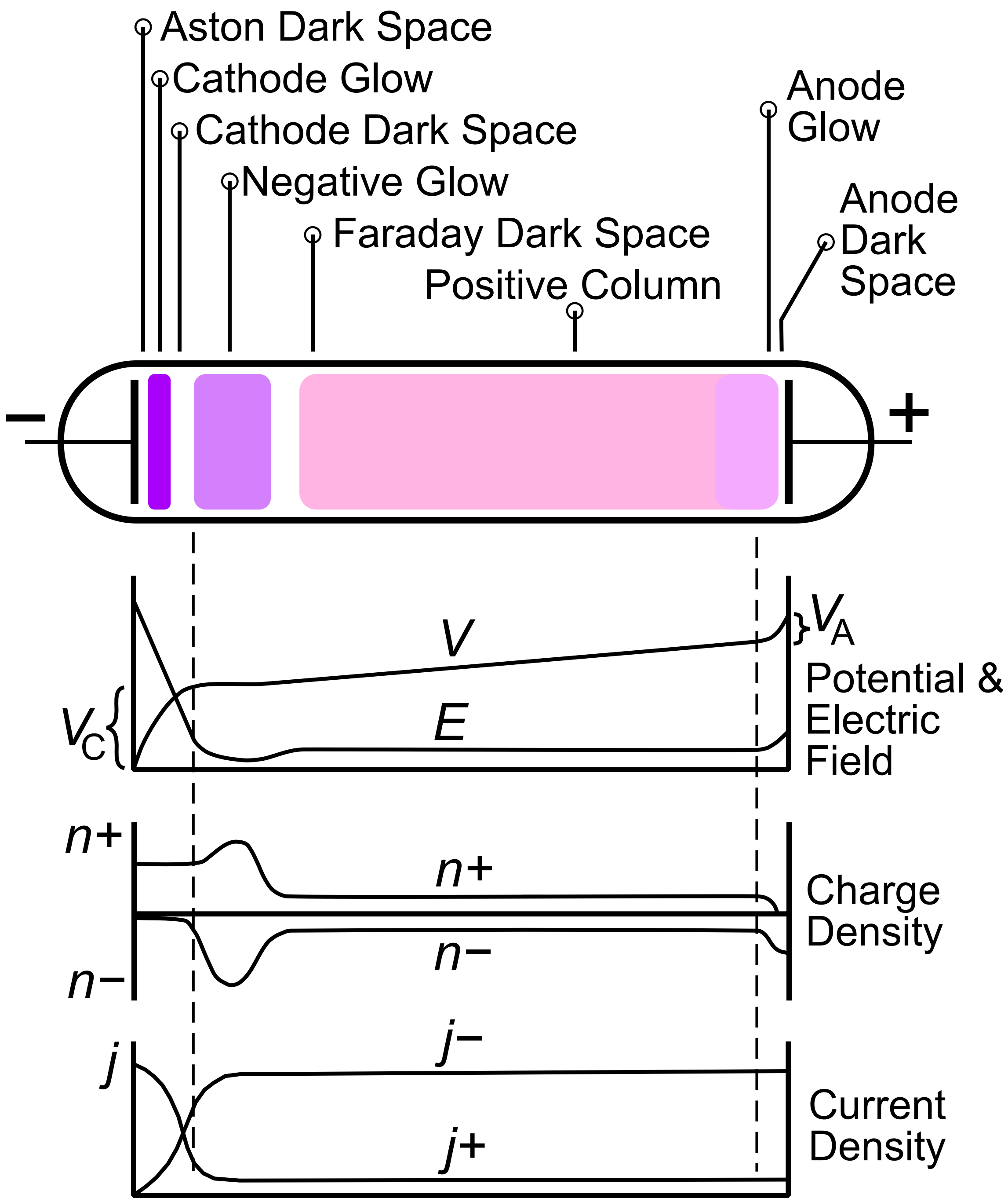


Paschen curves obtained for helium, neon, argon, hydrogen and nitrogen, using the expression for the breakdown voltage as a function of the parameters A,B that interpolate the first Townsend coefficient.[

$$V_{\mathrm{B}} = \frac{Bpd}{\ln(Apd) - \ln\left[\ln\left(1 + \frac{1}{\gamma_{\mathrm{se}}}\right)\right]}$$

where V_{B} is the breakdown voltage in volts, p is the pressure in pascals, d is the gap distance in meters, γ_{se} is the secondary-electron-emission coefficient (the number of secondary electrons produced per incident positive ion), A is the saturation ionization in the gas at a particular E/p (electric field/pressure), and B is related to the excitation and ionization energies.

The constants A and B interpolate the first Townsend coefficient $\alpha = Ape^{-Bp/E}$. They are determined experimentally and found to be roughly constant over a restricted range of E/p for any given gas. For example, air with an E/p in the range of 450 to 7500 V/(kPa·cm), A = 112.50 (kPa·cm)$^{-1}$ and B = 2737.50 V/(kPa·cm).[6]



A glow discharge illustrating the different regions comprising it and a diagram giving their names.