spark ionization and SSMS

Electron Impact ionization
(1918)

Spark Ionization
(1935)

Fast atom bombardment (FAB)
(1980)

Matrix-assisted laser desorption ionization
(MALDI)
(1985)

Solid sample analysis

New Ion Sources for Mass Spectroscopy

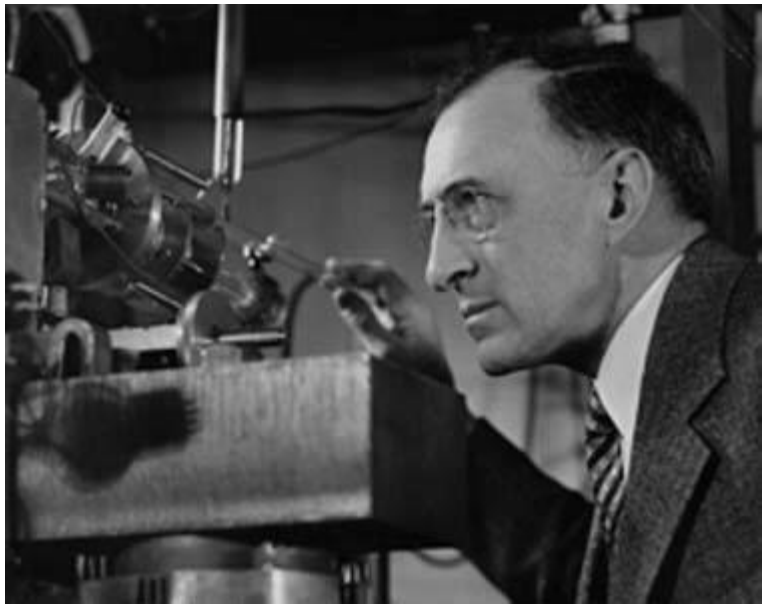
FOR use in connexion with a new mass-spectrograph, I have recently developed a new type of ion source in which positively charged atoms are formed by sparks between solid electrodes in a high vacuum. Spectroscopic studies in recent years have shown that these vacuum sparks are efficient sources of multiply charged ions. Several forms of sparks were tried; the '*trembleur à vide*', the 'hot-sparks' from a large condenser discharge, and finally a spark coupled inductively to a high-frequency oscillating spark circuit. This latter has proved very successful, and an abundance of ions has been obtained, thus far from the following elements: platinum, gold, tungsten, tin, copper, nickel, iron, aluminium, carbon, beryllium and lithium.

The ions were analysed provisionally by the Thomson parabola method after being accelerated by about 20,000 volts. The presence of multiply charged ions is in most cases very striking; spots occur with fractional electrostatic deflections, indicating ions that changed their charge before reaching the electric and magnetic fields. With platinum, for example, ions with all charges up to five occur, and with gold all charges up to four. It is of interest that ions of gold and platinum, which have not been found with other methods, are very easily obtained with these sparks.

A. J. DEMPSTER.

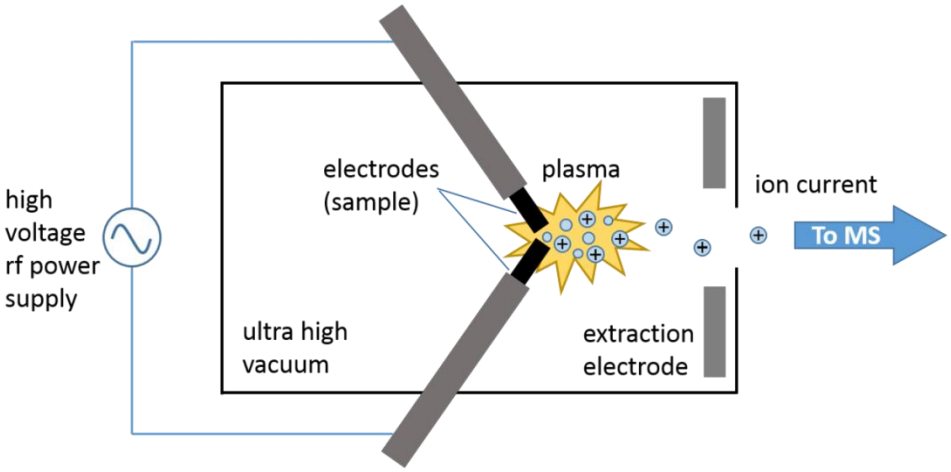
Ryerson Laboratory,
University of Chicago.
March 4.

1935



The prototype spark source instrument was the MS7 mass spectrometer produced by Metropolitan-Vickers Electrical Company, Ltd. in 1959

1) **low-voltage direct-current (DC) arc source-** a high voltage is applied to the two conducting electrodes to initiate the spark, followed by application of a low-voltage direct current to maintain an arc between the spark gap. The duration of the arc is usually only a few hundred microseconds to prevent overheating of the electrodes, and it repeated 50-100 times per second.

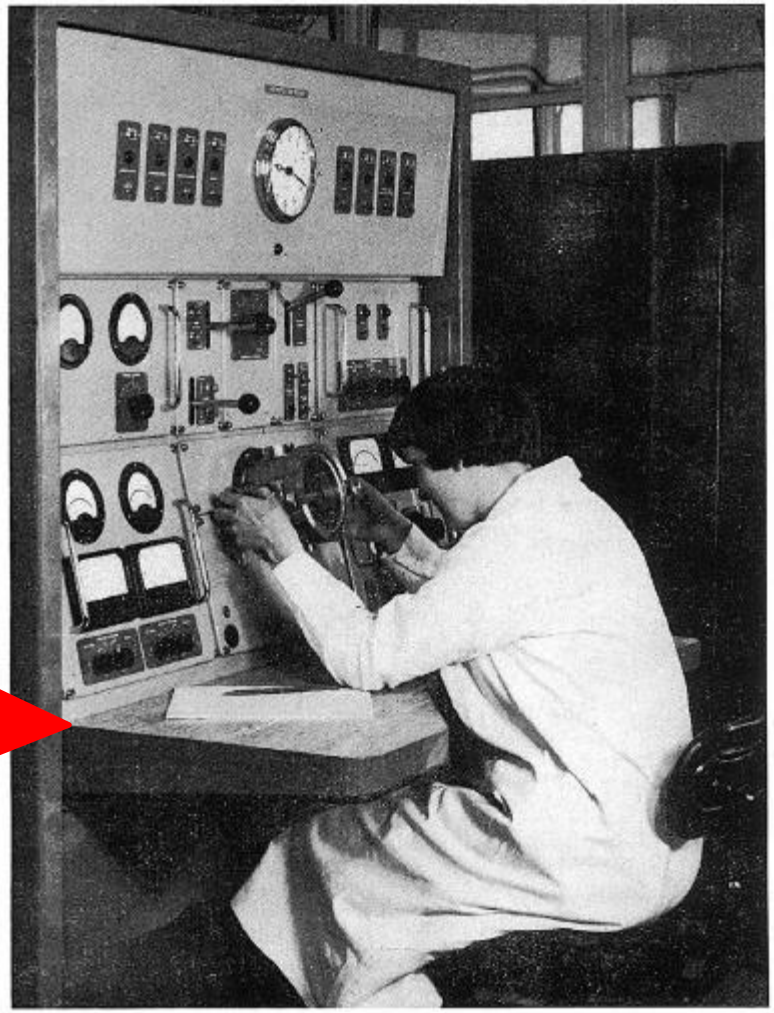


2) **high-voltage radio-frequency (rf) spark source-** samples are physically incorporated into two conductive electrodes between which an intermittent (1 MHz) high-voltage (50-100 kV using a Tesla transformer) electric spark is produced, ionizing the material at the tips of the pin-shaped electrodes. When the pulsed current is applied to the electrodes under ultra-high vacuum, a spark discharge plasma occurs in the spark gap in which ions are generated via electron impact. Within the discharge plasma, the sample evaporates, atomizes, and ionizes via electron impact.

EQUIPMENT

Spectrometer Bids for Trace Analysis

British firm brings out spark source unit as one of two new mass spectrometers, designs third



130,000$

Resolution 500-10000

The MS7, says AEI, will analyze all elements in a sample, both metallic and nonmetallic, with about the same sensitivity—down to 0.001 p.p.m. The

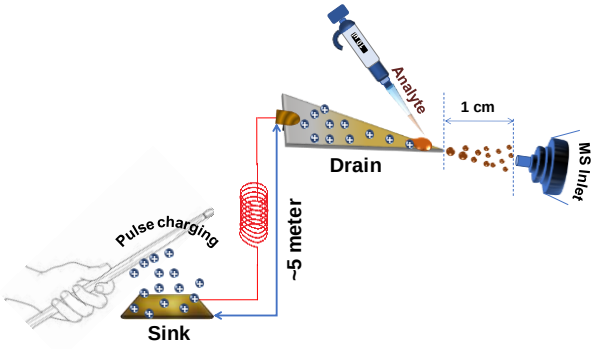
Merits of SSMS

1) high sensitivity with detection limits in the ppb range,
2) simultaneous detection of all elements in a sample,
3) simple sample preparation.

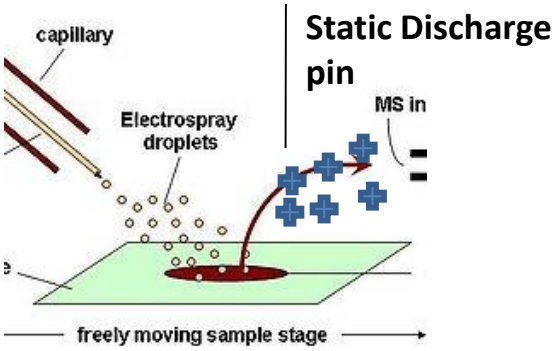
Demerits,

1) the rf spark ion current is discontinuous and erratic,
2) expensive equipment,
3) long analysis time, and
4) the need for highly trained personnel to analyze the spectrum.

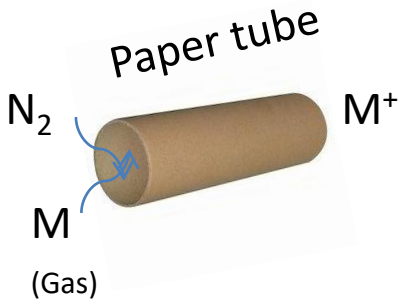
Electrostatic Induction Soft-hard ionization Mass Spectrometry (EISHI-MS)



Static discharge imaging mass spectrometry



Gas column ionization mass spectrometry (GCI-MS)



Thank You