Thermal Ionization Mass Spectrometry (TIMS)

1918-1920	First isotope ratio measurements by MS (180º sector instruments)
1920-1935	Isotope ratio measurements of most elements determined by EI/TI MS
1932-33	Development of triple-filament TIMS ion source
1940	Simple, 60º single-focusing sector MS design developed, with electrical ion detection (enabling MS research by many research groups)
1947	First commercial TIMS instruments become available
1969	First modern, automated TIMS instrument design
1982	First multi-collector TIMS instrument designs
1985	Negative ionization TIMS techniques developed
1998	Development of completely computer-automated TIMS instrumentation

Spark Source Mass Spectrometry (SSMS)

1935	Vacuum spark ion source developed
1947	First SSMS instrument built for analytical purposes
1951	SSMS with electrical detection demonstrated
1954	Mattauch-Herzog geometry SSMS built/demonstrated
1958	First commercial SSMS instruments become available
1964	Ilford Q2 photoplates become SSMS standard
1980-81	SSMS w/ improved electrical detection described
1985-90	Popularity of SSMS declines with advent of LA-ICPMS, GDMS
1990	Commercial availability of SSMS ceases

Flame Emission Spectrometry (FES)

1860	Chemical analysis by flame emission described
1879	Pneumatic atomizer for flame emission developed
1928	Premixed burner was developed
1935-1948	Flame emission spectrometers commercialized
1956	Simultaneous determination by flame emission spectrometry demonstrated

Atomic Absorption Spectrometry (AAS)

1802	Observation of AA lines
1817	Dark lines in solar spectrum observed
1929	Use of pneumatic nebulization with premixed air-C_2H_2 flame
1939	Use of AAS to determine Hg in air
1955	Atomic absorption developed as an analytical method
1959	Introduction of commercial AAS instruments
1959	Use of electrothermal atomization for AAS
1965	Deuterium-lamp background correction
1965	Introduction of N_2O-C_2H_2 flame
1968	Cold-vapor AAS used for Hg
1971	Zeeman effect used for background correction
1983	Pulsed hollow-cathode lamp background correction

Inductively Coupled Plasma Optical Emission Spectrometry (ICPOES)

1947	First ICP at atmospheric pressure reported
1961	First flowing ICP at atmospheric pressure reported
1964-65	First ICP-OES publications
1974	First commercial ICP-OES instrument
1976	Photodiode array detection for ICP-OES
1982	ICP-OES with Echelle spectrometer/solid state imaging detector described
1992-93	Commercial ICP-OES instruments with solid state imaging detectors available

Atomic Fluorescence Spectrometry (AFS)

1902-5	First observation of AFS
1963	Speculation about analytical utility of AFS

1964 First publication of AFS as analytical method
1966 Continuum-source AFS
1971 Laser-excited AFS
1972 Commercialization of flame-AFS instrument
1981 Introduction of commercial ICP-AFS instrument

Glow Discharge Emission/Mass Spectrometry (GDOES/GDMS)

1852 First sputtering in a glow discharge tube
1882 Rowland developed a new geometry of a spectrograph for emission spectroscopy
1906 Nobel Prize for physics for studies of electrical conductivity of gases and the discovery of the electron. Reduced pressure discharge and MS instrumentation utilized.
1967 New design of a glow discharge emission source
1968 First quantitative analysis with new GD source
1970 DC glow discharge ion source connected to a quadrupole mass analyzer
1970 First depth profiling demonstrated with a GD source
1972 Grimm glow discharge source characterized
1975 RF-powered glow discharge ion source developed
1978 First commercial GD-OES instrument (Grimm source)
1985 A glow discharge sector field mass spectrometer with high mass resolution launched
1988 First RF powered Grimm GD source
2005 High mass resolution sector field mass spectrometer with a GD ion source was launched

Inductively Coupled Plasma Mass Spectrometry (ICPMS)

1980-81 Seminal work reported with ICP's as elemental MS ion sources
1983-84 First commercial quadrupole ICPMS instruments become available
1985 Laser ablation first used with ICPMS for direct solids sampling
1987-1990 Alternate-gas plasmas investigated
1989 First sector-field, high-resolution ICPMS instrument described
1992 Multi-collector, sector-field ICPMS instrumentation debuts
1994-1997 Novel ICPMS designs (MHMS, ITMS, ToF-MS, FTICR-MS) investigated
1995-1996 Low-power, 'cool plasmas' techniques described for interference reduction
1996-1999 Collision/reaction cell ICPMS techniques described/commercialized
2002-present Applications developments: metallomic, elemental imaging, radioisotopes, etc.

Future Exploration

Radioisotopes – Radioisotopes are increasingly used for environmental monitoring and tracking, geochronology, medical diagnostics, and nuclear activities detection. In many cases atomic spectroscopy provides a more sensitive and selective analytical approach than more traditional radiation counting methods.

Metallomics – Metallomics is the study of metals and metal species, and their interactions, transformations, and functions in biological systems. Atomic spectroscopy, coupled with modern separation and biological mass spectrometry methods, provides a means to identify and quantify metalloproteins and other metal moieties.

Elemental Imaging – Elemental imaging, using atomic spectroscopy detection, provides nanoscale mapping and localization of metals and metalloids in biological, electronic and other materials, and geological samples.