a detector coupled to said ion drift cell to detect the ions.

38. The apparatus of claim 37 wherein said electrodes comprise a sliding tube electrode.

39. The apparatus of claim 37 wherein said electrodes comprise an electrode of hyperbolic shape.

40. An apparatus for separating and analyzing ions, comprising:

an ionization source to generate ions,

an ion drift cell coupled to said ionization source, in which the ions are separated according to their mobility and which comprises electrodes for focusing the ions, said focusing consisting of a combination of periodic field focusing and hyperbolic field focusing; and,

a detector coupled to said ion drift cell to detect the ions.

41. The apparatus of claim 40 wherein said combination consists essentially of a sequential combination of a periodic focusing field and a hyperbolic focusing field.

42. A method for separating and analyzing ions, comprising:

generating ions from an ion source,

separating ions in terms of their mobility wherein said step of separating comprises transporting the ions in a superposition of a periodic focusing field and a hyperbolic focusing field; and,

detecting said ions.

43. The method of claim 42 wherein said step of detecting comprises detecting with a mass spectrometer.

44. The method of claim 42 wherein said step of detecting with a mass spectrometer comprises detecting with a time-of-flight mass spectrometer having a flight tube positioned orthogonally with respect to the ion drift cell axis.

45. The method of claim 44 further comprising the step of fragmenting ions after the mobility separation and prior to said detecting with a mass spectrometer.

46. The method of claim 45 wherein said step of fragmenting ions comprises fragmenting ions by collisions of said ions with gas particles.

47. The method of claim 45 wherein said step of fragmenting ions comprises collisions occurring in an expanding gas flow during the transmission of said drift cell with said mass spectrometer.

48. The method of claim 47 further comprising increasing the collision energy of said ions with said gas particles by accelerating the ions in an electrical field within said expanding gas flow.

49. The method of claim 42 wherein said step of transporting comprises focusing with ring electrodes of conical shape.

50. The method of claim 42 wherein said step of transporting comprises focusing with thick plate ring electrodes beveled to possess a central hole wherein said central hole has a conical shape.

51. The method of claim 42 wherein said step of transporting comprises focusing in which unequal potential differences are applied between the electrodes.

52. The method of claim 42 wherein said step of transporting comprises focusing using electrodes with unequal hole diameters.

53. The method of claim 42 wherein said step of transporting comprises focusing by unequal spacing between the electrodes.

54. The method of claim 42 wherein said step of transporting comprises focusing by cup-shaped electrodes.

55. The method of claim 42 wherein said step of separating comprises separating using a stack of electrodes with insulating material between those electrodes.

56. The method of claim 55 further comprising sealing said stack with sealing rings in order to seal said drift section.

57. The method of claim 55 further comprising positioning said electrodes along the axis of said drift chamber using positioning rings.

58. The method of claim 55 further comprising positioning said electrodes along the axis of said drift chamber using a positioning tube.

59. The method of claim 58 wherein said positioning also seals said drift chamber.

60. The method of claim 42 wherein said step of generating ions comprises:

ionizing sample using an ionizing beam directed to the sample positioned on a sample holder, said sample holder having a surface to accommodate a sample to receive said ionizing beam.

61. The method of claim 60 further comprising the step of redirecting said ionizing beam onto said surface using one or more mirrors positioned to so that said ionizing beam can enter from behind said surface.

62. The method of claim 60 further comprising the step of redirecting said ionizing beam onto said surfaces using one or more mirrors positioned so that said ionizing beam can enter said drift chamber essentially orthogonally to the drift chamber axis.

63. The method of claim 60 further comprising the step of sequentially exposing several samples to the ionizing beam.

64. The method of claim 63 where said step of sequentially exposing comprises rotating said sample holder.

65. The method of claim 63 where said step of sequentially exposing comprises moving said sample holder to a position orthogonal to the axis of said drift cell.

66. The method of claim 63 where said step of sequentially exposing said samples comprises using a moving belt to deliver said samples.

67. A method for separating and analyzing ions, comprising:

generating ions from an ion source,

separating ions in terms of their mobility wherein said step of separating comprises transporting the ions in a hyperbolic focusing field; and,

detecting said ions.

68. The method of claim 67 wherein said electrodes comprise a sliding tube electrode or an electrode of hyperbolic shape.

69. A method for separating and analyzing ions, comprising:

generating ions from an ion source,

separating ions in terms of their mobility wherein said step of separating comprises transporting the ions in a combination of a periodic focusing field and a hyperbolic focusing field; and,

detecting said ions.