[0086] Persons skilled in the art can easily use this invention as the starting point to develop further application methods and further embodiments. These application methods and embodiments shall be included here in this patent protection application.

What is claimed is:

1. A method for sorting ions into a first group of ions that are pushed over an electric field barrier by a flow of a gas and a second group of ions that are held back by the electric field barrier, comprising:

(a) forming the flow of the gas as a jet by adiabatic expansion of the gas through a nozzle.

2. The method of claim **1**, wherein step (a) comprises adiabatically expanding the gas through a Laval nozzle.

3. The method of claim **1**, wherein step (a) comprises locating the nozzle in a wall between two chambers of a differential pumping system.

4. The method of claim **1**, further comprising (b) measuring the first group of ions without mass separation by an ion detector.

5. The method of claim **1**, further comprising (b) measuring the first group of ions with mass separation by a mass analyzer.

6. A method for sorting ions, comprising:

(a) entraining the ions in a flow of gas;

(b) forming the flow of the gas into a jet by adiabatic expansion of the gas through a nozzle; and

(c) placing an electric field barrier downstream in the flow of gas from the nozzle, the electric field barrier having a height so that the ions are sorted into a first group of ions that are pushed over an electric field barrier by the flow of a gas and a second group of ions that are held back by the electric field barrier.

7. The method of claim **6**, wherein step (c) comprises generating the electric field barrier by DC potentials or RF pseudopotentials at one or more electrodes.

8. The method of claim **6**, wherein the nozzle has an exit from which the jet issues and step (c) comprises locating the electric field barrier adjacent the nozzle exit.

9. The method of claim **6**, wherein the nozzle has an exit from which the jet issues and step (c) comprises locating the electric field barrier at a predetermined distance from the nozzle exit and placing an ion guide around the jet between the nozzle exit and the electric field barrier so that ions are contained in, and redirected into the gas jet.

10. The method of claim **9**, wherein step (c) comprises forming the ion guide as one of an RF multipole rod system, an RF ion funnel, and a system of parallel diaphragms with apertures, alternately connected to one of DC voltages of alternating polarity and two phases of an RF voltage.

11. The method of claim **10**, wherein step (c) comprises forming the RF multipole rod system with sufficiently thin pole rods, and fitting the apertures of the diaphragms with skimmers, so that expanding gas outside the jet can escape without substantial hindrance.

12. The method of claim **10**, wherein the electric field barrier height is variable and step (c) comprises varying at least one of the magnitude and frequency of the RF voltage at the ion guide as the height of the electric field barrier is varied.

13. The method of claim **9**, further comprising:

(d) adjusting the height of the electric field barrier so that ions are collected in the ion guide;

(e) stopping generation of the ions;

(f) lowering the height of the electric field barrier; and

(g) measuring an ion current of ions pushed over the lowered electric field barrier by the gas jet to directly measure the ion mobility.

14. The method of claim **13**, wherein step (g) comprises acquiring a series of mass spectra as the height of the field barrier is lowered in step (f), and extracting mobility spectra of ions of individual mass ranges without differentiation from the series of mass spectra.

15. The method of claim **14**, further comprising:

(h) examining the mobility spectra extracted in step (g) to select ions with predetermined mobilities; and

(i) acquiring fragment ion spectra of the selected ions.

16. The method of claim **6**, wherein step (a) comprises supplying a continuous current of ions from an ion source, and wherein the method further comprises:

(d) varying the height of the electric field barrier;

(e) measuring the ion current of the first group of ions as a function of the height of the field barrier; and

(f) differentiating the ion current with respect to the height of the field barrier to generate a mobility spectrum.

17. The method of claim **16**, wherein step (e) comprises acquiring a series of mass spectra and extracting ion current curves for ions of individual mass ranges from the mass spectra, and wherein step (f) comprises differentiating the ion current curves to generate mobility spectra.

18. The method of claim **16**, wherein the gas in which the ions are entrained has a temperature and wherein the method further comprises:

(g) changing the temperature; and

(h) acquiring mobility spectra at various gas temperatures to determine conformational changes of the ions.

19. An ion mobility spectrometer, comprising:

an ion source that entrains ions in a gas flow;

a differential pumping system, transporting the gas flow and ions through a plurality of sequential pumping chambers;

a nozzle having an exit and being located in a wall between two of the pumping chambers, so that the gas flow passes through the nozzle and generates a gas jet with ions at the nozzle exit;

a device for generating adjacent to the nozzle exit an electric field barrier having an adjustable height; and

an ion detector that measures a current of ions that are pushed over the electric field barrier by the gas jet.

20. An ion mobility spectrometer, comprising:

an ion source that entrains ions in a gas flow;

a differential pumping system, transporting the gas flow and ions through a plurality of sequential pumping chambers;

a nozzle having an exit and being located in a wall between two of the pumping chambers, so that the gas flow passes through the nozzle and generates a gas jet with ions at the nozzle exit;

an ion guide having an entrance located at the nozzle exit and an exit, the ion guide maintaining and redirecting ions into the gas jet;

a device for generating adjacent to the ion guide exit an electric field barrier having an adjustable height; and

an ion detector that measures a current of ions that are pushed over the electric field barrier by the gas jet.

21. The ion mobility spectrometer of claim **20**, wherein the ion detector comprises a mass spectrometer.

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