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A new principle mass spectrometer using two rotating electric fields

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We have invented a new type of mass analyzer, based on a different principle from that of magnetic-sector, Time-of-Flight (TOF) or quadrupole mass separators. The new principle involves introducing a pair of Rotating Electric Fields (REFs). Although earlier studies have already used an REF as the basis of mass separation, a single REF is seldom sufficient for separating ion trajectories based on the ion mass. Those studies also included TOF theory for REF based mass separation. In theory, the new mass analyzer with two REFs shows great promise for separating ion trajectories based on the ion mass. It features a compact ion optical system, which can be designed to fit within a polyethylene terephthalate bottle. The two REFs are generated by applying an AC voltage to a pair of octagonal electrodes optimized with a SIMION™ simulator, in terms of both shape and interval. The REFs rotate with the same speed and axis, albeit with opposite phases. We developed a prototype of this REFs mass analyzer using an optimized pair of octagonal electrodes and a Focused-Ion-Beam (FIB) column. and demonstrated the potential to separate different masses simultaneously within continuous beam and also separate gigantic masses i.e. cluster ions, polymer ions and proteins.

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