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Atmospheric Measurement Techniques Discussions

Interactive comment on "Electrodynamic balance–mass spectrometry of single particles as a new platform for atmospheric chemistry research" *by* Adam W. Birdsall et al.

Anonymous Referee #1

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General Comments:

This manuscript describes an instrument that allows individual particles several micrometers in diameter to be trapped in an electrodynamic balance (EDB) over a period of hours to days where various physical and/or chemical transformations may take place, followed by online chemical analysis with mass spectrometry. In the current version of the instrument, particles exiting the EDB strike a heated probe, where molecular species are vaporized and then ionized in a corona discharge. This combination of techniques represents a significant addition to the arsenal of trapping methods used to study physicochemical processes relevant to atmospheric aerosol. The authors do

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Discussion paper

a nice job of reviewing previous work with EDB technology and/or mass spectrometric detection. The authors might consider including a sentence or two on the use of optical traps since these are also used with great success to study atmospherically relevant particles.

Specific Comments:

1. The topic of droplet size and the ion signal intensity produced from it should be discussed more coherently in the manuscript. The authors mention 10-30 micrometers in the introduction, but it is not clear whether this is limited by the balance or mass spectrometer. In section 2.4, the authors indicate an initial droplet volume for their experiment of $\sim$140 pL, which then shrinks as water evaporates. In section 2.6 they assume a droplet size of 9-11 um in their model. However, droplet size and/or analyte mass sampled is not given in the discussion or captions of Figures 2 and 3. Nor is it discussed in any detail Section 3.4, which otherwise gives an excellent discussion of particle-to-particle signal variability. One gets the sense that the absolute signal variability is much greater than the 20-30% normalized signal variation reported by the authors. Furthermore, it seems that the PEG droplet size studied in this experiment represents a practical lower limit, since working with a smaller size would probably have led to an unacceptably high fraction of particle spectra being filtered out from further analysis. This is not a criticism of the current work, since the method is very powerful in its current incarnation. However, the topic could use more attention in the text.

2. Section 2.2. Spring point measurements were made with 18 um diameter PMMA spheres. Is it possible that the existence of doublets and/or larger aggregates of PMMA spheres could have influenced the results?

3. Section 3.2.1. “Particle” in line 13 of this page (fourth line of the section) should be plural.

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