

Interactive comment on “Laser ablation aerosol particle time-of-flight mass spectrometer (LAAPTOF): Performance, reference spectra and classification of atmospheric samples” by Xiaoli Shen et al.

Anonymous Referee #1

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The authors present performance data and reference spectra from the commercially available LAAP-TOF single-particle mass spectrometer. The manuscript is of a technical nature and provides a characterisation of the instrument that can be used as a platform for future scientific investigation with this instrument model. In addition, an alternative particle classification method is presented and compared to the fuzzy clustering algorithm provided by the instrument manufacturer. Although performance data in terms of detection efficiencies have previously been reported in the literature, the instrument has been the subject of continual development; consequently data for this

C1

particular example of the instrument design is relevant. The reference spectra presented in this manuscript are from a wide variety of atmospherically relevant particles types and are likely to be very useful to other users of this instrument platform. I gladly recommend this manuscript for publication in AMT.

General Comments: There are number of details that should be addressed before publication. The manuscript can be difficult to read in places and some streamlining of the introduction would help. Also, the authors should be careful to state which conclusions are drawn from which measurements, particularly when the detection efficiency with respect to particle size is discussed. Finally, the comparison of the clustering results with reference spectra is very informative and should be given more prominence in the abstract and conclusions.

Specific Comments:

Pg1, ln16. Only the PSL was measured at the size range stated.

Pg1, ln21. It is not clear what is meant here. Clarify that you are using two methods to analyse the ambient data?

Pg1, ln31. This paragraph could be streamlined.

Pg2, ln53. Not sure this review of SPMS history is necessary.

Pg2, ln67. There is an instrument commercial available from Hexin instruments, China.

Pg2, ln68. How is the beam spot diameter known? Measured or referenced?

Pg2, ln73. In Figure2, the ODE of 1% appears to be achieved BEFORE instrument modification. Which is correct, the figure or the text?

Pg3, ln82. Zawadowicz (2017) has a beam spot size of 100 μ m after focussing.

Pg3, ln84. Improved optical counting efficiency (2-3 order of magnitude) with respect to what?

C2

Pg3, ln94. This paragraph should be in the method section.

Pg4, ln119. Is there a reference for the stated transmission efficiency?

Pg4, ln123. Was the beam diameter measured or referenced? This is important for the stated power density.

Pg4, ln124. Power density is measured in W/cm3. Are the authors referring to 'Intensity'?

Pg4, ln. Differences in peak position mainly occur due to differences in kinetic energy of the ions produced. A suitable reference should be given.

Pg5, ln163. It is not clear how particles are sampled from the 'Head space of their reservoirs'

Pg5, ln 165. This paragraph is a repeat of the information offered in the introduction.

Pg5, ln175. The definition 'scattering efficiency' is ambiguous as it can be confused with the optical properties of the particle rather than the efficiency of the system. Suggest 'particle detection efficiency' or similar.

Pg6, ln 205. The authors should be clear if they are discussing the LAAP-TOF detection efficiency specifically. It is possible to detect particle smaller than 200nm with some systems.

Pg7, ln216. A size range should be given for this statement. The scattering efficiency of non-spherical particles $> 1\mu\text{m}$ is not reported in this manuscript.

Pg7, ln217. This paragraph is confusing and should be re-written. It should be clear if the authors are discussing the optical properties associated with absorption and hit-rate or the optical properties associated with particle detection. Please us the definitions already given in the manuscript.

Pg7, ln233. The information in this paragraph was already given in the introduction.

C3

Pg8, ln252. Can the authors offer any data to support the conclusion that mass spectral signatures increase with particle size?

Pg8, ln275. Are the authors referring to detector ringing? Detector ringing in MCPs is caused by pulse reflections and therefore should not be counted as ion signal.

Pg12, ln437. Please explain what 'spectrum-to-spectrum peak shifts' is referring to and how that impacts the assignment of particle type.

Pg13, ln447. This paragraph contains some nice conclusions about particle classification and should be given more prominence in the manuscript.

Pg13, ln454. Only PSL was measured in that size range.

Typos/Technical:

Pg2, ln 51. Sentence structure.

Pg 2, ln 55. Home-built.

Pg3, ln76. 'Number percentage' should be 'number fraction'?

Pg3, ln104. Remove 'Major'.

Pg3, ln106. Insert 'and' after SOA.

Pg3, ln109. Sentence structure.

Pg5, ln194. Check the spacing after the references.

Pg10, ln360. Poor sentence structure.