

## ***Interactive comment on “Aerosol composition and sources during the Chinese Spring Festival: fireworks, secondary aerosol, and holiday effects” by Q. Jiang et al.***

**Anonymous Referee #1**

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General comments:

The manuscript reports the chemical composition of non-refractory particulate matter with vacuum aerodynamic diameter less than 1 micron (NF-PM<sub>1</sub>) measured by an Aerodyne Aerosol Chemical Speciation Monitor (ACSM) in Beijing, China during the Chinese Spring Festival. The field study focuses on evaluating the potential impacts of fireworks and a short-term reduction of population in Beijing during the holiday on air quality as well as the significance of secondary aerosol (both inorganics and organics) formation. The manuscript provides important insight in terms of air quality control strategies that reducing primary local emissions only have limited influences to improve

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the air quality in Beijing, thus highlighting the importance of joint efforts over regional scales for air pollution control in northern China. Overall, I recommend this manuscript to be published after addressing the specific comments below:

Specific comments:

1. Section 2.3: There are a few issues on the quantification of K and Cl ions using ACSM data: 1) Page 20623, line 20-21: The meaning of “PMF modelled m/z 74” is unclear. Figure S2 does not provide any explanation. Please provide details. 2) Page 20623, Line 19: Drewnick et al. (2006) did not calibrate their ToF-AMS using chemical standard and thus estimated the RIE of 2.9 for K<sup>+</sup>, which is based on the potassium-to-sulfate ratio (2.76) determined by PIXE analysis on fireworks aerosol sample from Dutcher et al. (1999). The RIE of K<sup>+</sup> could be instrument dependent. Can the authors perform a similar comparison and comment on the accuracy of using RIE of 2.9 for K<sup>+</sup> quantification in this study? 3) Page 20623, Line 25-26: Organic aerosol contributes to fragment C<sub>3</sub><sup>+</sup> at m/z 36 in ambient environment. Can the authors estimate the uncertainty due to the presence of fragment C<sub>3</sub><sup>+</sup> to the quantification of HCl<sup>+</sup> based on the non-fireworks period?

2. Page 20625, line 2-4 and line 20-23: 1) Please confirm whether the meteorological conditions during LF period were stagnant. The wind direction was changing during LF period (It is hard to read in the print out of Figure 1, please see recommendation in technical comments). 2) The authors suggest that their estimation represents the upper limits of fireworks aerosol contributed to the total PM due to several reasons. However, it is not clear whether the pollutants in particular PM were carried to or removed from the sampling location due to wind direction changes. Please clarify.

3. Page 20267, line 12-14: Even though LV-OOA component has been considered as aged secondary organic aerosol (SOA) in ambient, it is likely not straightforward to comment on the nature (primary vs. secondary) of OA generated in FW period based on the mass spectral features alone. First, the FW-OOA mass spectra may

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depend on the manufacturing materials (such as organic component if any) of firework. Furthermore, the freshly formed SOA (i.e. SV-OOA) are generally less oxygenated (i.e. lower O:C) and has a lower organic signal at m/z 44 than LV-OOA. However, it would be interesting to understand if it is possible to create a highly oxidizing ambient environment during fireworks for LV-OOA production.

4. CAPS measurement: Was there any RH control before the CAPS inlet? Secondary inorganic species are hygroscopic in nature, thus resulting in larger size and higher extinction efficiency under high RH. Please clarify.

5. HOA and BC in holiday period: 1) Page 20630, line 24-29: In general, heavy-duty vehicles/diesel trucks emit more black carbon (BC) compared to gasoline vehicle. Reduction of BC and slight increasing of HOA during holiday period suggests that significant fraction of BC was emitted from sources (i.e. coal combustion) other than diesel vehicles in Beijing. 2) Page 20631, line 3-4: The authors argue that HOA showed comparably lower concentration during holiday, but it is contradict to the previous discussion (Page 20630, line 24-25) and Figure 8 (Ratio\_HD/NHD of HOA  $\sim$ 1). Please justify.

Technical comments:

1. Page 20623, line 17: Please change the equation to “m/z 39 – (m/z 43 x 0.45)”

2. Figure 1 and Figure S9: 1) K and KCl signals are tracers for the fireworks aerosol particles as shown in Figure S9. Since the focus of Section 3.1 and 3.2 is to investigate the short-term impacts of fireworks on air quality, it is recommended to include time series of K and KCl in Figure 1 and refer the zoom in to Figure S9 in order to clearly illustrate the impacts of fireworks on different aerosol species. 2) Please also include wind direction plots in Figure S9 as it is often discussed in the text but it is hard to compare different time series in Figure 1. 3) The gray color for the clean periods is not clearly showed in Figure 1. Please change the color.

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3. Page 20267, line 21: Change “overestimate” to “underestimate”?

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