This paper analyzes data from springtime observations at the Hyytiälä observatory carried out in 2011, 2012, and 2013. Measurements of ion chemical composition were made using the Atmospheric Pressure interface Time of Flight Mass Spectrometer (APi-TOF), while measurements of precursor vapor concentrations (H2SO4, and HOM) were measured by chemical ionization mass spectrometry. NH3 was also measured. In addition, a DMPS system was used to measure aerosol size distributions (3-990 nm), and neutral particle (2.5-42 nm) and ion (0.8-42 nm) number distributions were measured with the NAIS. These data were used to calculate particle growth rates and ion induced and neutral particle nucleation rates. Some evidence for ion induced nucleation (IIN) was found on about 50% of measurement days, although IIN rates were less than neutral particle nucleation rates. When IIN was observed, anions comprised of H2SO4-NH3 were dominant on about 50% of the time. However, when [HOM]/[H2SO4] exceeded 30, the dominant IIN pathway appeared to involve HOM. This is a nice study that provides valuable new insights into the chemical processes that lead to IIN at this location. It is significant work based on excellent observational results. The paper is concise and clearly written. I recommend publication in ACP, and offer a few suggestions for the authors to consider.

We would like to thank the referee for the suggestions and careful editorial comments. We reply to the comments item by item below (text in blue):

Suggestion:
On p. 11 the authors point out that the likelihood of H2SO4-NH3 IIN depends strongly on [H2SO4]/CS. When this ratio equaled about 10^{10} $cm^{-3}s$, IIN was observed, while IIN was far less likely when [H2SO4]/CS=109 cm-3s. McMurry and coworkers (McMurry et al. 2005) argued that the likelihood that nucleated clusters will grow into new particles decreases rapidly when the dimensionless parameter, L, exceeds a value on the order of 1. Kuang and coworkers (Kuang et al. 2010) showed that new particle formation was rarely observed when L>0.7. From equations [A3] and [A5] of McMurry et al (2005), it is straightforward to show that:

$$L = \frac{CS}{[H_2SO_4]} \cdot \frac{1}{\beta_{11}}$$

where β11 is the collision rate between H2SO4 vapor molecules. A characteristic value for β_{11} is 4.4e-10 cm^3s^{-1}. It follows than for these data, H2SO4-NH3 IIN was observed for L~0.22 but not for L~2.2. This is consistent with theoretical expectations and prior work, and would move the authors closer to providing a quantitative theoretical explanation for the S-E IIN results shown in Figure 5F.
Indeed, adding the discussion on the parameter L will move the observation towards more quantitative. We have added the following discussion:
"McMurry and coworkers (Mcmurry et al., 2005) have introduced a parameter L (Eq.3) to quantitatively evaluate the likelihood of NPF, and they found that NPF mostly occurred when L is smaller than 1. A similar result has been reported by Kuang et al., (2010), and a slightly different threshold L value 0.7 was determined.

$$L = \frac{CS}{[H_2SO_4]} \cdot \frac{1}{\beta_{11}} \text{ (Eq.3)}$$

Here, L is dimensionless parameter representing the probability that NPF will not occur, and β_{11} is the collision rate between H_2SO_4 vapor molecules, which is characterized as 4.4×10^{-10} cm^3s^{-1}. Our results suggest a consistent L that most (75 percentile) S-E cases happen when L is lower than 0.73 and most (75 percentile) S-NE cases are observed when L is larger than 1.54."

Points that should be clarified.
•Line 26, p. 1: "All such clusters were observed..." In the context of this sentence, this implies that all clusters from #S=3 to infinity were observed. This is obviously not what is intended.
We explicitly mention the maximum number of H2SO4 in the sentence now:
"controlled the appearance of H_2SO_4-NH_3 clusters (3< #S < 13): All such clusters were observed when [HOM]/[H_2SO_4] was smaller than 30."

• p. 4, line 120: "...a best instrument..." The previous sentence acknowledges that some

fragmentation occurs. It might also be mentioned that the extent of fragmentation is not quantitatively understood. Have the authors confirmed that the APi-TOF produces less fragmentation that other mass spectrometers with different interface designs? I don't think so.
The referee is right that fragmentation is very likely to happen inside the instrument, which has not been well quantified. On the other hand, as we stated in the manuscript, no ionization can be used if we aim to measure these weakly bonded clusters. Under such circumstances, the APi-TOF is very suitable for cluster measurement. As also pointed out by the other referee, we replace "a best instrument" by "a well suited instrument".

Minor editorial corrections:
The paper contains numerous minor, distracting language errors, which I illustrate with the following examples. The text should be thoroughly edited by a native English speaker.
•p. 2, line 57: should be "as ion-induced..."
Modified.

•p. 4, lines 111-112: "..often dominates the daytime spectrum in the daytime when it is abumdant,..." ???
We removed the "daytime" in the sentence.

•p. 4, line 118: replace "comparing" with "compared"
Modified.

•p. 4, line 127: delete ","
Modified.

•p. 5, line 163: delete "In specific,"
Modified.

•p. 11, Figure 3 caption: replace "unclear is IIN..." with "unclear if IIN..."
Modified.

•p. 11, line 285: delete "however" (Alternatively, it could be separated using commas, but this would make for an awkward sentence.)
Modified.

•p. 12, line 309: "this type of days..."
Modified

•p. 12, line 310: "are conduce of IIN events..."
Our original wording seems right.

•p. 12, line 315: "has not been evidenced,..."
Modified

•p. 14, Figure 5: Difficult to distinguish blue from black boxes.
We change the black box to grey in Figure 5.

•p. 14, line 349: "This indicate the..."
Modified.

•p. 15, line 371: "The abundancy and ..."
Modified.

Kuang, C., I. Riipinen, T. Yli-Juuti, M. Kulmala, A. V. McCormick and P. H. McMurry (2010).

"An improved criterion for new particle formation in diverse atmospheric environments." Atmospheric Chemistry and Physics 10: 1-12. doi: 10.5194/acp-10-1-2010.
McMurry, P. H., M. A. Fink, H. Sakurai, M. R. Stolzenburg, L. Mauldin, K. Moore, J. N. Smith, F. L. Eisele, S. Sjostedt, D. Tanner, L. G. Huey, J. B. Nowak, E. Edgerton and D. Voisin (2005). "A Criterion for New Particle Formation in the Sulfur-Rich Atlanta Atmosphere." Journal of Geophysical Research - Atmospheres 110: D22S02. doi: 10.1029/2005JD005901.