Physical and Mathematical Basis for the Particle Mass Calibration
Aerodyne Aerosol Mass Spectrometer

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AMS Calibration Math I

1. Ion Flux Correction for Quad. Transmission & Multiplier Response

\[ I_{\text{corrected}}^{\text{sf}} = \frac{I_{\text{measured}}^{\text{sf}}}{T_{m/z} G_{m/z}} \]

2. Molecular flux vs. ion signal

3. Species mass concentration:

\[ C_s = \frac{M_s MW_s}{N_A Q} = \frac{I_{\text{corr}}^{\text{sf}}}{N_A Q X_{\text{sf}}} \frac{MW_s}{IE_s} \]

4. Empirical relationship between relative IE of different species (due to physics of electron ionization)

- NO₃ equivalent mass w/o $R_t$

5. Final expression to calculate species mass concentration

$$
\frac{IE_s}{MW_s} = \frac{1}{R_t} \frac{IE_{NO_3}}{MW_{NO_3}}
$$

$$
C_s = R_t \frac{\sum I_{sf}^{corr}}{N_A Q X_{sf}} \frac{MW_{NO_3}}{IE_{NO_3}}
$$

Empirical basis for relationship between IE/MW for different species

AMS Postcalibration

- The previous procedure allows us to calculate the evaporated molecular flux
- If there are other reasons why molecules are not evaporated, we use an empirical correction factor
  - Particles not focused (shape)
  - Particles not focused (size cuts of the lens, critical orifice)
  - Slow vaporization of very low volatility species

\[ C_{scaled} = R_{emp} C_s \]

- Not accounting for different chemical forms of some species (e.g. NaSO$_4$ vs. (NH$_4$)$_2$SO$_4$ => NR Sulfate, NR Nitrate)