

Resonance-Enhanced Multiphoton Ionization inside the C-trap of an Orbitrap Mass Spectrometer

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Motivation



- Polycyclic aromatic hydrocarbons (PAHs) are of increasing interest due to diverse environmental and health effects
- Trace analysis in gas, liquid, particle state necessary to monitor the exposure
- •REMPI offers the possibility to selectively ionize PAHs with high efficiency [3,4]
- •REMPI is mainly hyphenated with time-of-flight (TOF) mass analyzers (mass resolutions from 1000-10000 $m/\Delta m$)
- Isobaric complexity of environmental and petrochemical samples demand higher mass resolution and accuracy
- •REMPI for sensitive and selective PAH speciation was successfully implemented on an OrbitrapTM (OT) mass analyzer offering high

m/z 200), dynamic range, and mass accuracy

 Instrumental realization required complete dissembling and reconstruction of the OT, removing multiple ion optic elements



 Restructuring of the system in a new custom rack for field operation and online measurements





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Figures of Merit and Application

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Summary and Outlook •First proof of principle realization and evaluation of REMPI at high-resolution Orbitrap platform Investigation of primary emission scenarios are of great interest (evolved gas analysis) **Applicative Outlook** Instrumental Adaption and Outlook Filter sampling and desorption for Toxic and carcinogenic compounds from engine exhausts [7] studying a variety of particle sources Different Laser wavelength (KrF Excimen 9th harmonic of Nd:YAG, Optical Parametric Oscillator) Oxy-PAH from wood combustion [8] Utilizing high repetition rate lasers to increase ion yield and sensitivity by Coffee roasting [9] creating several ionization events during ion accumulation of the C-Trap

•Coupling to other devices possible (e.g., thermal analyzers [10] thermo-optical carbon analyzers [11])

•Use of other wavelengths to access different molecular intermediate states (shift selectivity to other chemical compounds)

 Use of high repetition rate laser to increase duty cycle of the instrument (multiple ionization events during ion accumulation of the C-Trap)

•Sensitive + selective vacuum photoionization by REMPI

- Direct ionization inside the C-trap
- •Non-heated and heated inlet (GC coupling applicable)
- Successful evaluation on complex petrochemical materials

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