Lighting Technology Institute — University Karlsruhe - Germany

Time resolved measurements of spectral radiant flux from VUV to NIR (140 nm < λ < ≈ 1000 nm) of Xe excimer lamps

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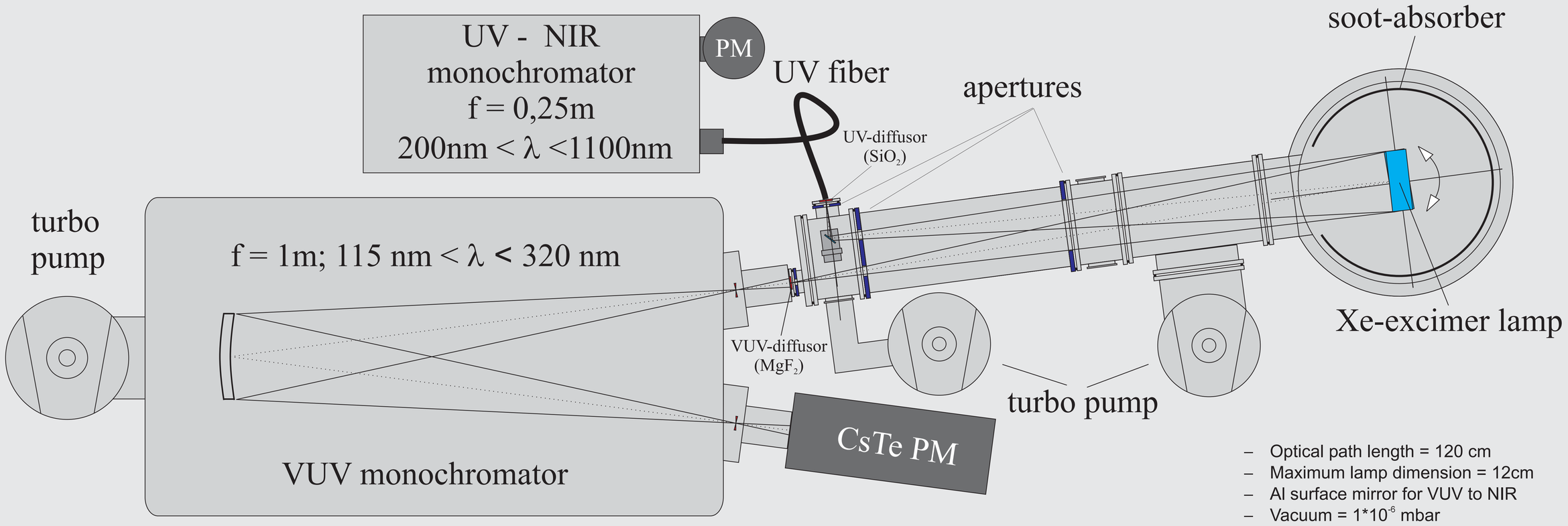
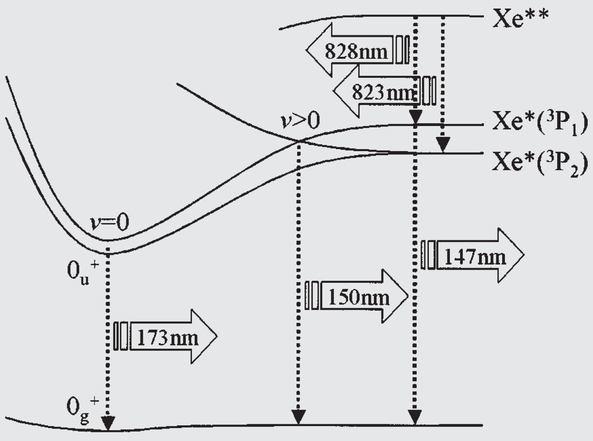


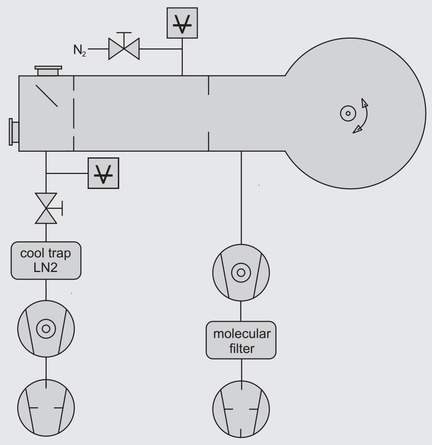
- Optical path length = 120 cm
- Maximum lamp dimension = 12cm
- Al surface mirror for VUV to NIR
- Vacuum = 1*10^{-6} mbar
- Rotary axis for lamp

Xe-Excimer - Principles



- extremely non-equilibrium plasma
- plasma current in the timescale of 10 ns to 100 ns
- ionisation through electron impact
- Excimer formation through 3 body collision of one excited Xe* and two neutral Xe atoms
- Formation of excited atoms through decay from higher levels Xe** with emission in the NIR (823 nm and 828 nm) **OR**
- direct excitation from the ground state through electron impact
- part of Xe* formation through direct excitation depends on the voltage pulse form

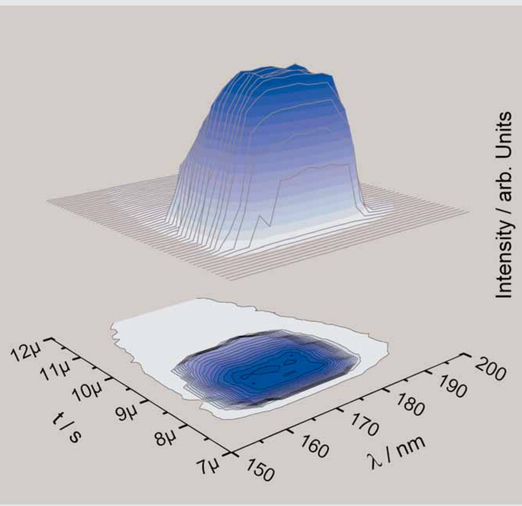
VUV - NIR Goniometer



vacuum layout

+ wavelength range from 115 nm < λ < 1300 nm (depending on diffusor material and PM)
+ photometric distance adhered (distance lamp-diffusor = 120 cm => lamp dimension < 12 cm)
+ ability to measure radiance distribution curve in VUV
+ absolute calibration with deuterium lamp in VUV - UV
+ reduction of stray radiation through soot-absorber < 0.13 %
+ 3 apertures for each optical path
+ very low uncertainty for optical measurement (115 nm < λ < 230 nm; F < 11,7 %)
+ high reproducibility with an uncertainty under 3,9 %
+ simultaneous VUV- and NIR measurements
+ photo multiplier for time-resolved measurement

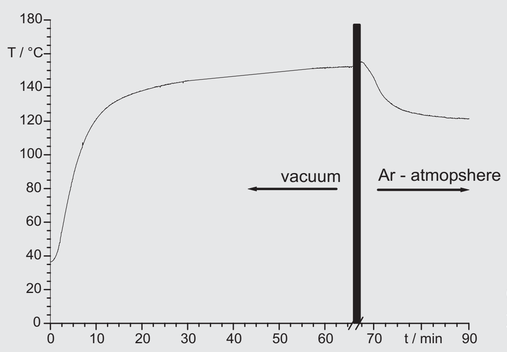
temporal behavior of Xe-Excimer emission in VUV

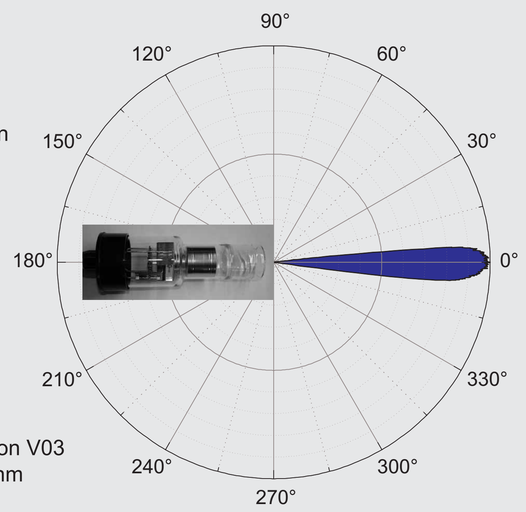


- Ability to measure time. and wavelength resolved
- Due to very low signal on the PM, averaging over around 100 pulse cycles.
- Direct synchronisation on the pulse generator with external clock signal.
- First measurements show an unexpected dependence of time and wavelength

calibration with deuterium lamp under vacuum

- flare angle 12,6° (FWHM)
- constancy >98% for angels < 2.5° from centre line
- temperature increase in vacuum 30 K
- up to now the temperature effect on radiance is unknown

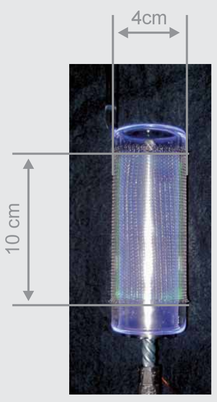


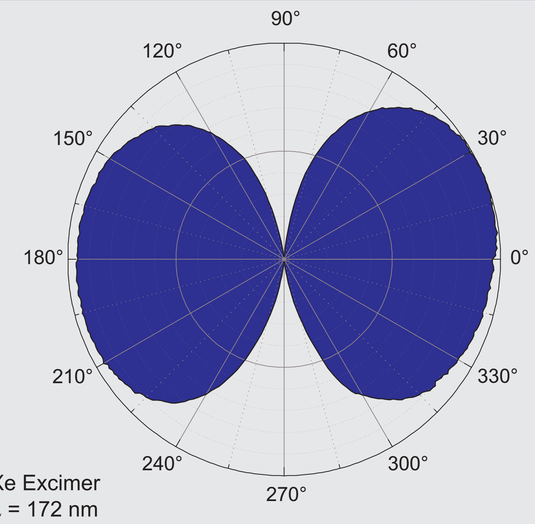


Cathodeon V03
λ = 210 nm

angel dependence of a coaxiallamp

- lamp is made of quartz tubes (suprasil 311)
- synthetic, high-purity fused silica with the best transparency in VUV
- unsymmetric angle dependence due to non perfect electrodes
- I(180°) x 2π overrates about 38 %

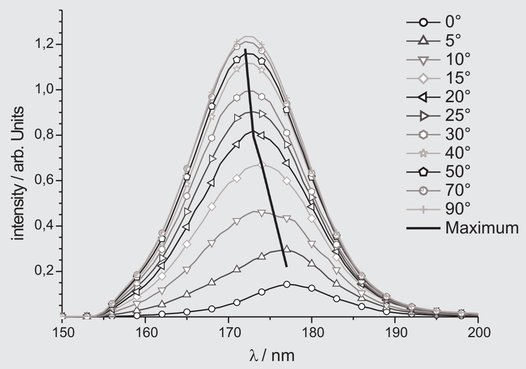


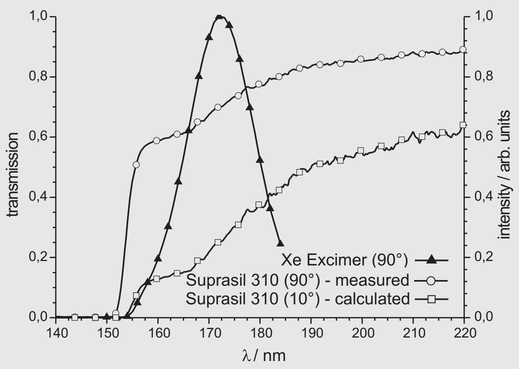


Xe Excimer
λ = 172 nm

angel dependence of spectrum

+ angel dependence of spectrum due to absorption edge of synthetic quartz
+ optical path gets longer for small angel of incidence => higher attenuation for shorter wavelength





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works on the development of freely shapeable barrier discharge lamps since 01-2002

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