

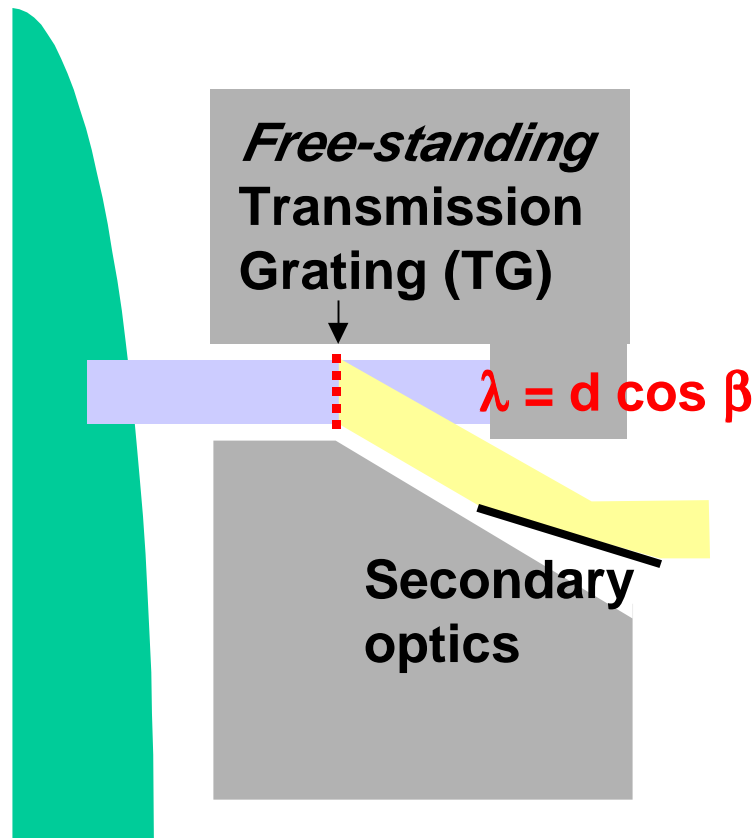
Soft X-ray to VUV diagnostics for ITER

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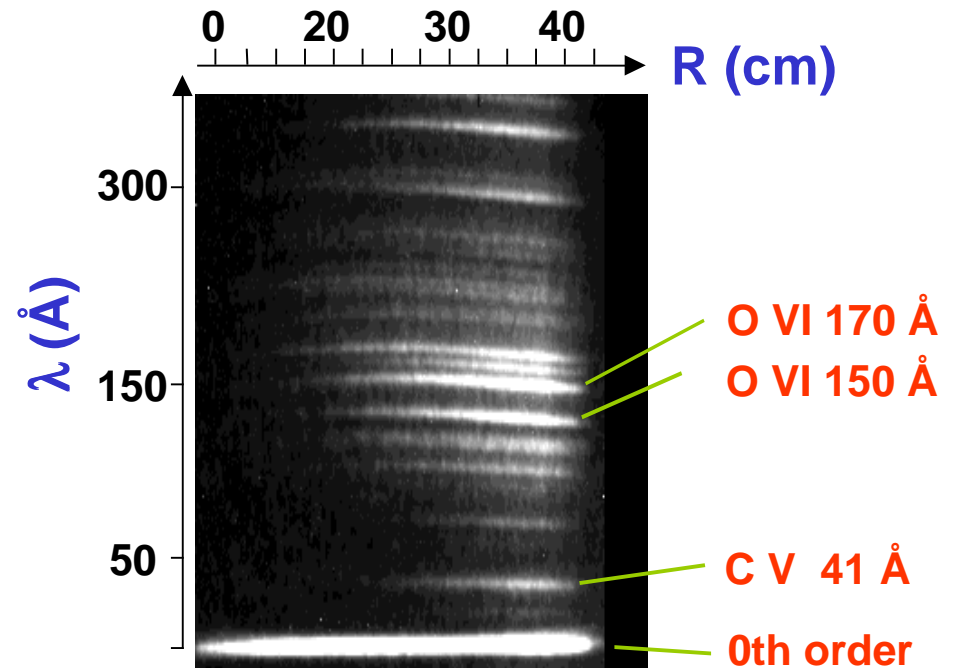
Johns Hopkins Plasma Spectroscopy Group

- **New ideas and R&D strongly needed for:**
 - Light extraction and detection**
 - Robust and modular imaging devices**
 - Atomic modeling tools**
- **Independent/alternate measurements of critical parameters essential**
- **Basic ITER diagnostics (CXRS, MSE, magnetics) prone to large uncertainties (first mirror, calibration, and SNR issues)**
- **SXR-VUV imaging spectroscopy can provide**
 N_z , Z_{eff} , T_e , plasma shape & position, current profile constraint

Light extraction

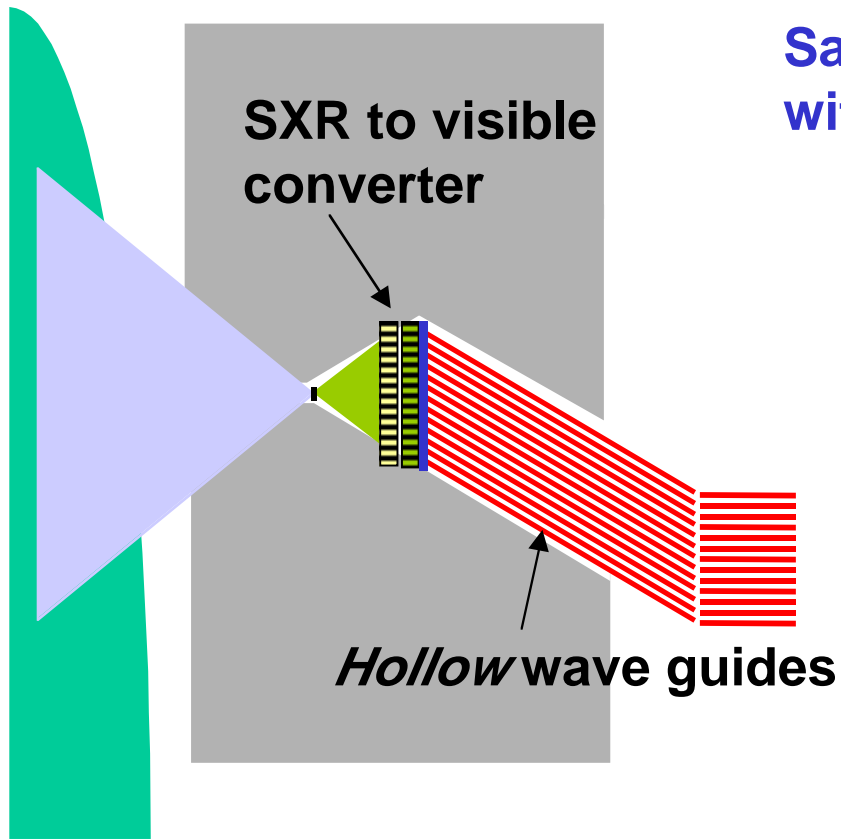


Space resolved CDX-U tokamak spectrum obtained with TG

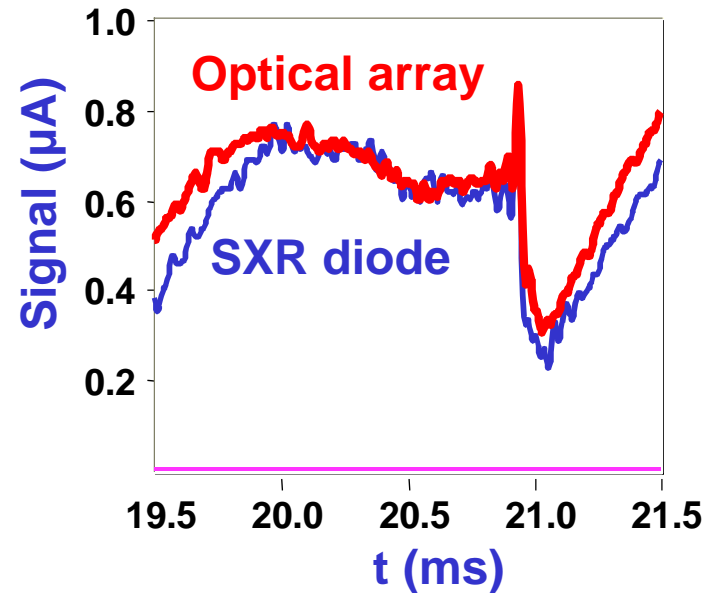


- *Transmissive-diffractive* elements (tungsten grids) could avoid reflectivity degradation encountered with mirrors
- Approach might be scalable to longer wavelengths

Light detection



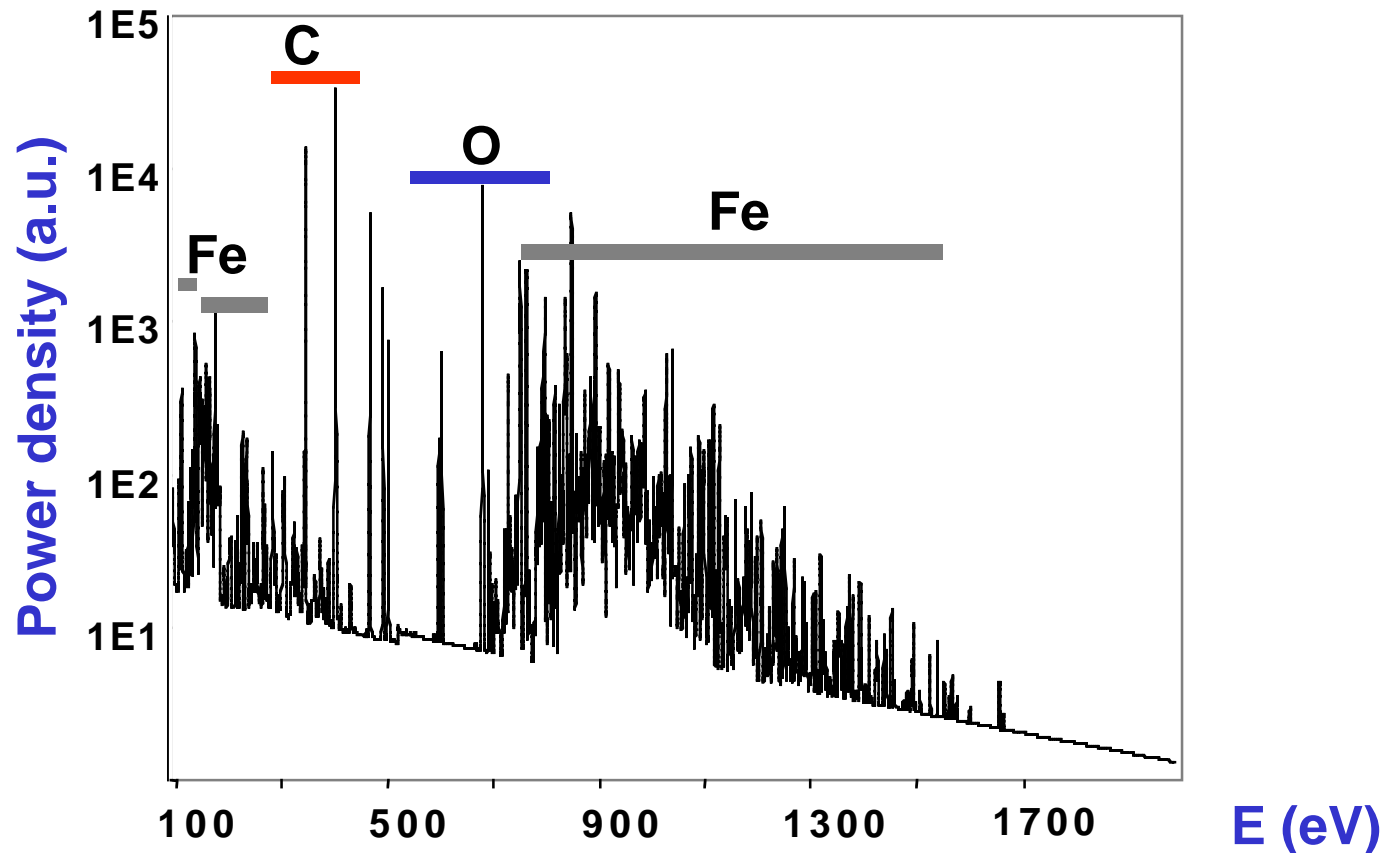
Sawtooth crash measured in CDX-U with optical vs. conventional detector



- ‘Optical arrays’ of **converter / hollow wave guides** may enable wide angle SXR-VUV measurements
- Imaging designs possible with such extraction/detection techniques

Modeling tools

HULLAC simulation of tokamak spectrum
($\langle T_e \rangle = 0.6$ keV, Fe 0.02%, C 1.5%, O 0.25%)



- Prediction of **instrument specific** spectral patterns essential
- Develop HULLAC database for low to high-Z elements in ITER