First Lasing of the SXFEL

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SXFEL: Project Scope

‘phased’ project

• 1. SXFEL Test Facility (SXFEL-TF)
  • Schedule: 2014.12 -, under commissioning
  • Budget: $35M
  • Design goals: ~300m tunnel, 840 MeV Linac, 8.8nm seeded FEL
  • Source: national funding agency

• 2. SXFEL User Facility (SXFEL-UF)
  • Schedule: 2016.10 -, under construction
  • Budget: ~$110M
  • Design goals: add 250mx50m FEL and experiment halls, upgrade to 1.5 GeV, 2 FEL lines, 5 end-stations
  • Source: local and national funding agencies
The SXFEL Test Facility in 2016

Baseline parameters
Beam energy: 0.84 GeV
FEL output: 8.8 nm
Overall length: 293 m
FEL type: HGHG-HGHG
EEHG-HGHG

上海同步辐射光源SSRF
3.5 GeV 第三代同步辐射光源
2009年正式开放，超过15000名用户
13条光束线投入运行
~18条在建设中（二期2016-2022）
FEL Test Facility

**Linac**
- Bunch charge (nC): 0.5 ✓
- Beam energy (MeV): 840 ✓
- Normalized emittance (mm.mrad, rms): ≤ 2.5 ✓
- Peak current (A): ≥ 500 ✓

**FEL**
- Radiation wavelength (nm): < 9 ✓
- FEL Pulse length (fs): 100-200 ✓
- Peak power (MW): ≥ 100 commissioning
SXFEL-TF commissioning milestones

- **2016**: Start commissioning of the injector and main linac during the installation of undulators
- **2017**: First coherent signal from the 1st stage HGHG
- **2018**: Amplification of the 1st stage EEHG. Pulse energy of the 3rd harmonic radiation exceeds 1 mJ
- **2019**: Cascaded HGHG FEL lased at 30th harmonic (8.8nm)

**Additional Milestones:**
- First soft x-ray radiation from the undulator beamline
- HGHG: 2nd to 6th harmonic
- Coherent signal from EEHG-30@8.8nm
- Saturation of HGHG-11 and EEHG-11
- Lasing of the 1st stage HGHG at 6th harmonic and get coherent signal from the 2nd stage HGHG with “fresh bunch”
Lasing of EEHG-11@24nm at SXFEL-TF

HGHG/EEHG comparison

Lasing of EEHG-11@24nm
• Three undulators
• Pulse energy >20μJ, Peak power >100MW

Amplification of the 1st stage HGHG at 44nm
8.8 nm FEL successfully amplified, its pulse energy is several μJs, and the peak power is around a few tens of MWs
Summary

- EEHG Lasing @24nm
  - Pulse energy > 100 μJ
  - Peak power > 100 MW

- First stage FEL (44nm, HGHG)
  - Pulse energy > 20 μJ
  - Peak power > 100 MW

- Second stage FEL (8.8nm, HGHG-HGHG)
  - Pulse energy > 7.5 μJ
  - Peak power > 30 MW

Commissioning is still going on, and the final goal (100MW) is not far ...
Thanks for your attention!