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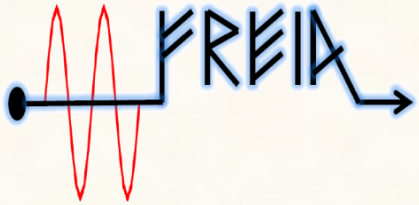
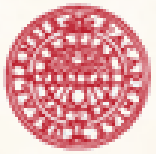
Compact





UPPSALA
UNIVERSITET

SOME POINTS FOR DISCUSSION

Vitaliy Goryashko

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Roadmap

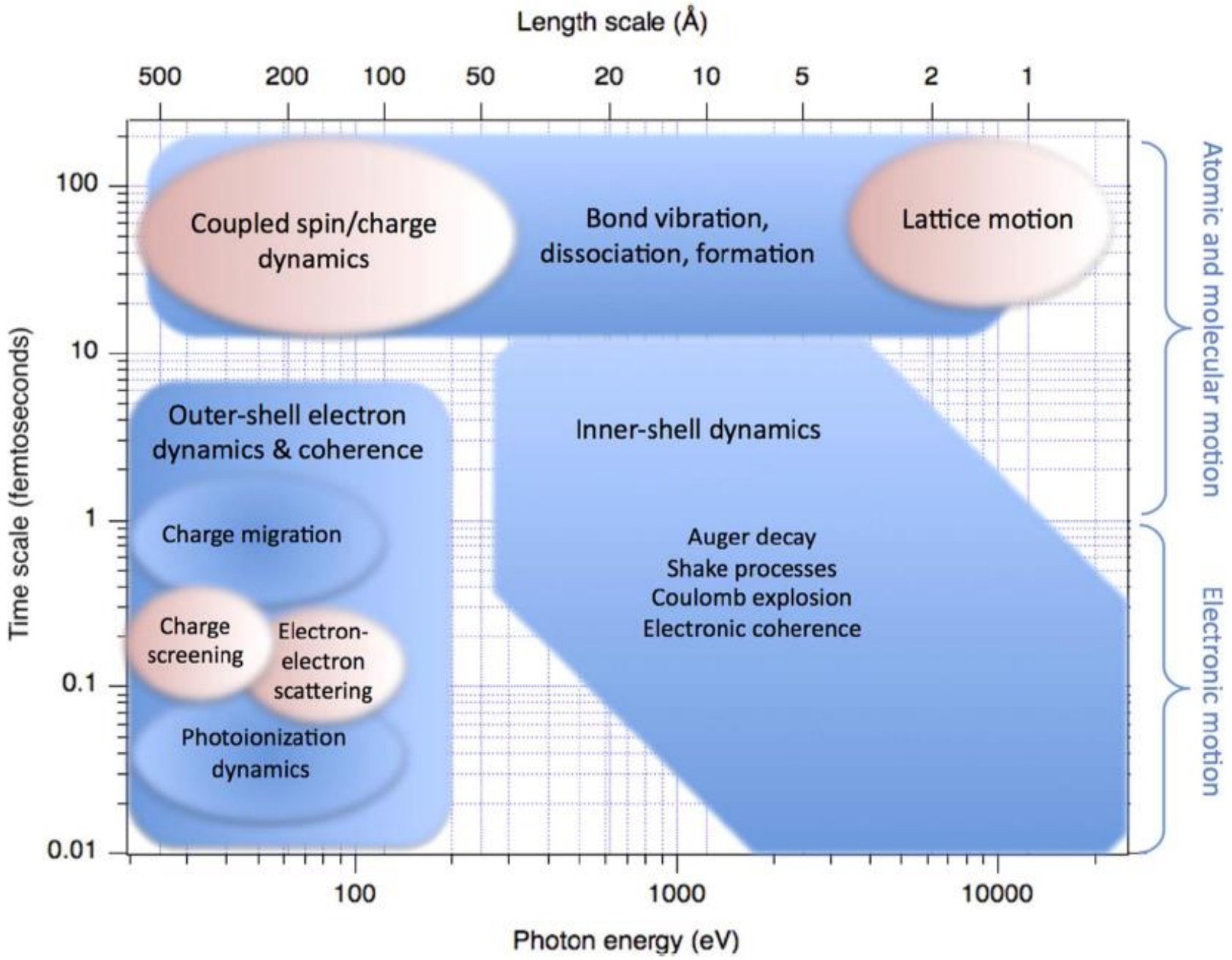
Roadmap of ultrafast x-ray atomic and molecular physics

Linda Young[1,2,22], Kiyoshi Ueda[3], Markus Gühr[4,5], Philip H Bucksbaum[5,6], Marc Simon[7], Shaul Mukamel[8], Nina Rohringer[9,10], Kevin C Prince[11], Claudio Masciovecchio[11], Michael Meyer[12], Artem Rudenko[13], Daniel Rolles[13], Christoph Bostedt[1], Matthias Fuchs[5,14], David A Reis[5], Robin Santra[9,10], Henry Kapteyn[15,16], Margaret Murnane[15,16], Heide Ibrahim[17], François Légaré[17], Marc Vrakking[18], Marcus Isinger[19], David Kroon[19], Mathieu Gisselbrecht[19], Anne L'Huillier[19], Hans Jakob Wörner[20] and Stephen R Leone[21]

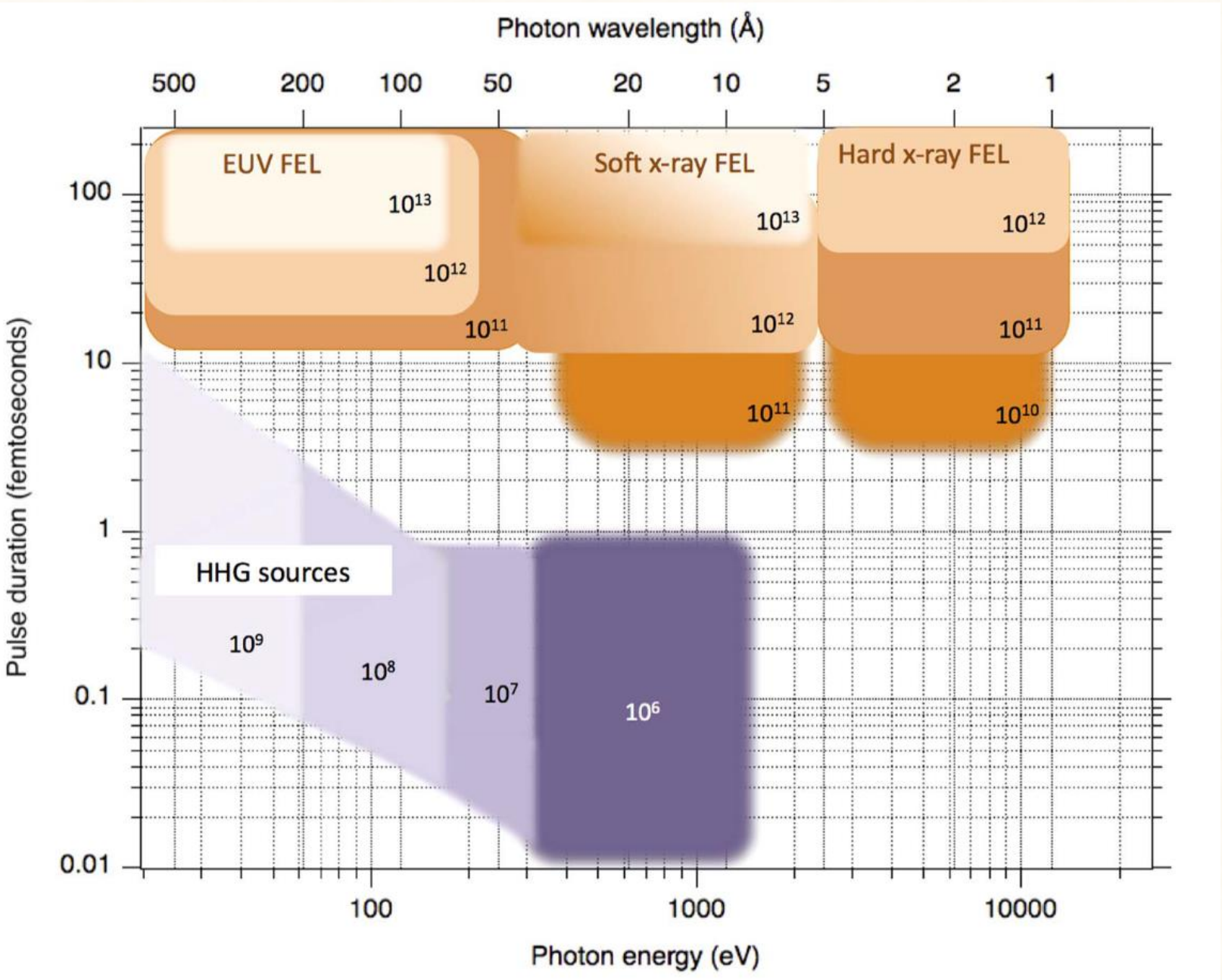
Roadmaps by key specialists from 20 labs and universities: Argonne lab and Chicago university, SLAC and Stanford, Berkley, Sorbonne, DESY, Elettra, Max Born Institute, Tokyo university, Lund university, ETH Zurich.

We should seriously consider this roadmap of ultrafast science.

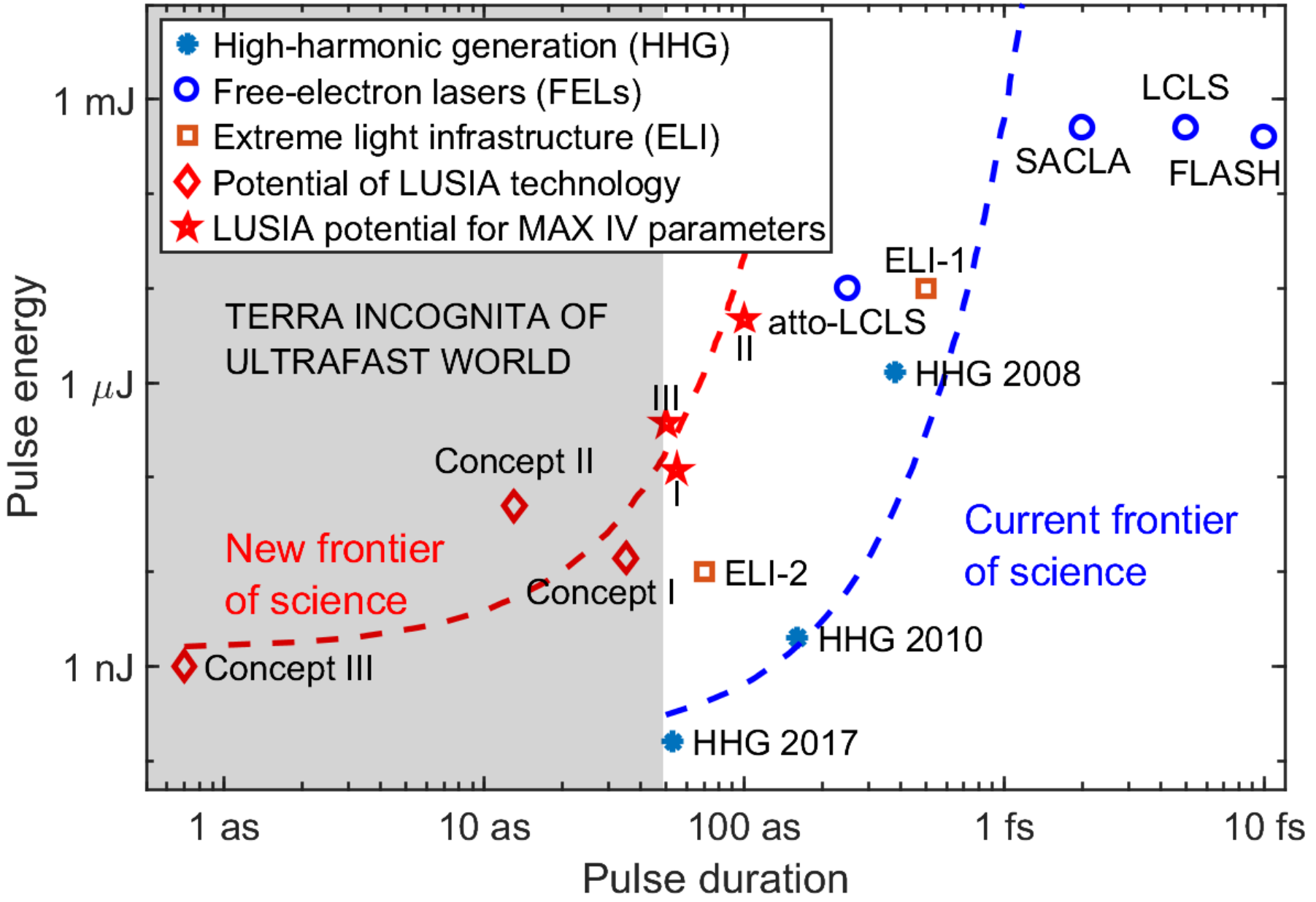
Roadmap by L. Young et el.



Roadmap by L. Young et el.



LUSIA = **A**ttosecond **Si**ngle-cycle **U**ndulator Light



Dream Compact Coherent Attosecond FEL

Mark-1 SLAC
X-band gun:
5-6 MeV
20 pC
250 fs
0.35 mm mrad
1 kHz (?)

CLIC
X-band linac:
1 GeV
20 pC
20 fs
0.4 mm mrad
10^(-4) spread
1 kHz (?)

undulator:
30-50 mm
100 periods
K = 1-10
Tapering or
afterburners
with chicanes

User station:

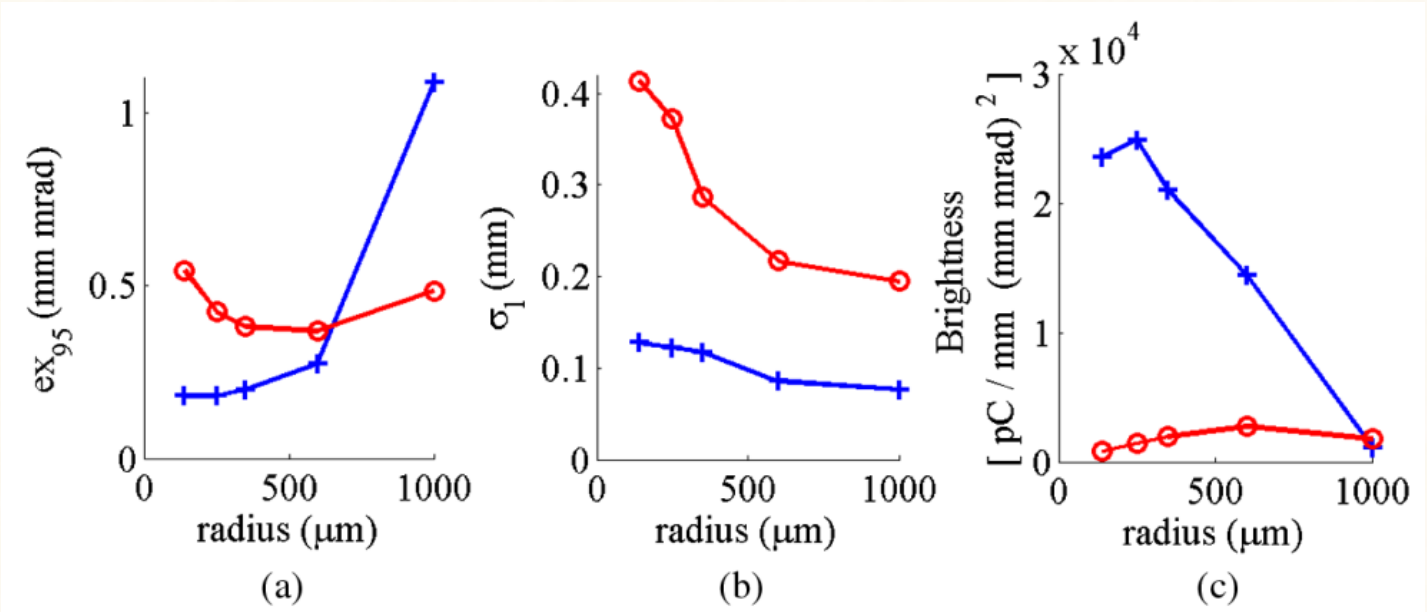
2 m **20 m** **10 m** **10 m**

The attosecond FEL looks really as a compact FEL!

- widely tunable
- has potential to excel the performance of HHG by 3-4 orders of magnitude.

Performance of a first generation X-band photoelectron rf gun

C. Limborg-Deprey,* C. Adolphsen, D. McCormick, M. Dunning, K. Jobe, H. Li, T. Raubenheimer, A. Vrielink, T. Vecchione, F. Wang, and S. Weathersby



The maximum peak brightness is 10 times larger for X-band than for S-band.

FIG. 9. Results from 100 pC bunch charge parameter scans as a function of the laser spot size radius where the blue crosses are for X-band (200 MV/m cathode field) and the red circles are for S-band (120 MV/m cathode field}: (a) minimum 95% transverse emittance, (b) minimum bunch length and (c) maximum peak brightness.

Measurements of SLAC X-band gun

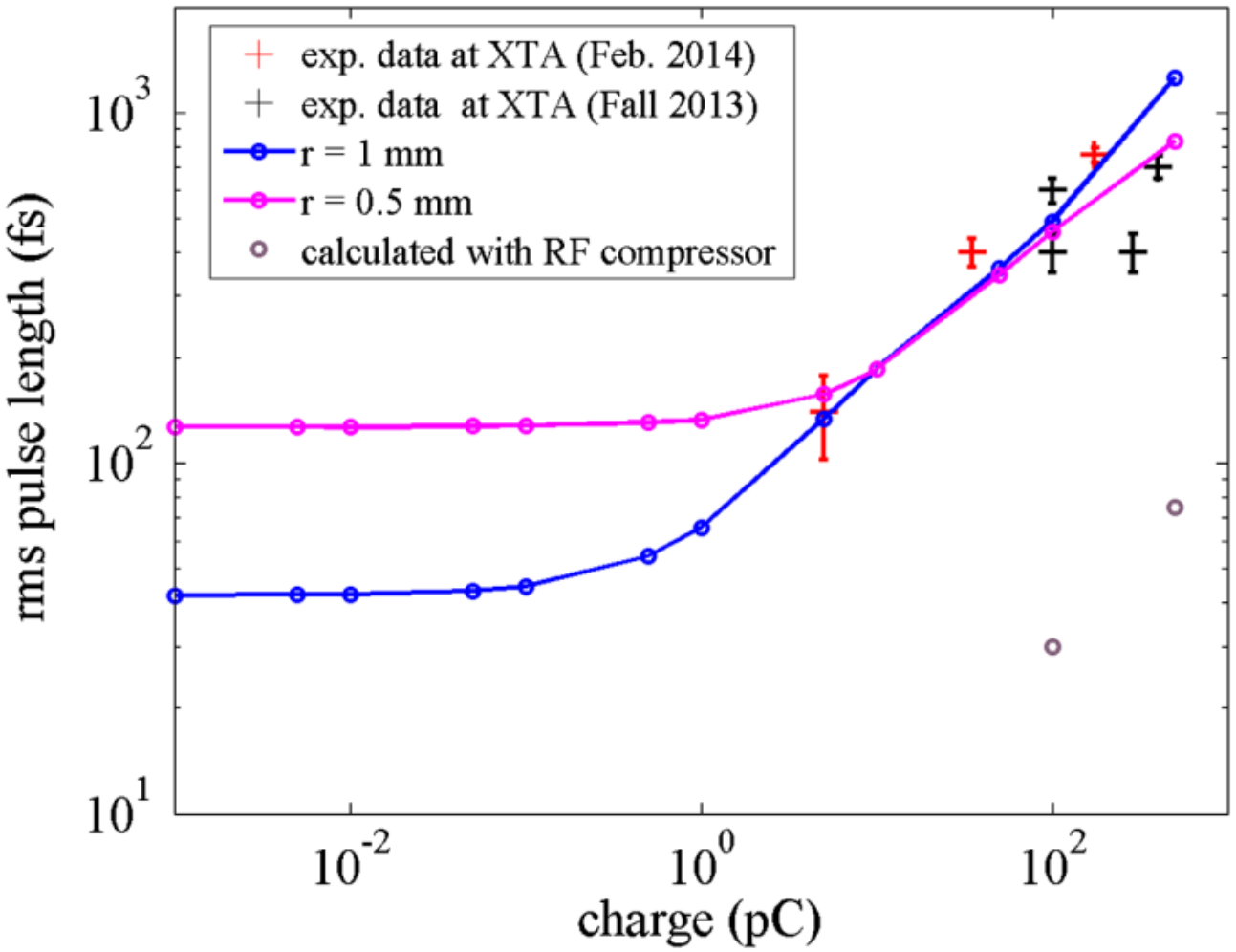


FIG. 21. Bunch lengths measured at the transverse deflector versus bunch charge, and simulated data as described in the text. Two additional simulated data points, in purple, show the bunch length when a 20-cm long RF compressor is used.

measured
400 fs, 100 pC
bunches

Having short bunches right from the gun might reduce the number of required bunch compressors.