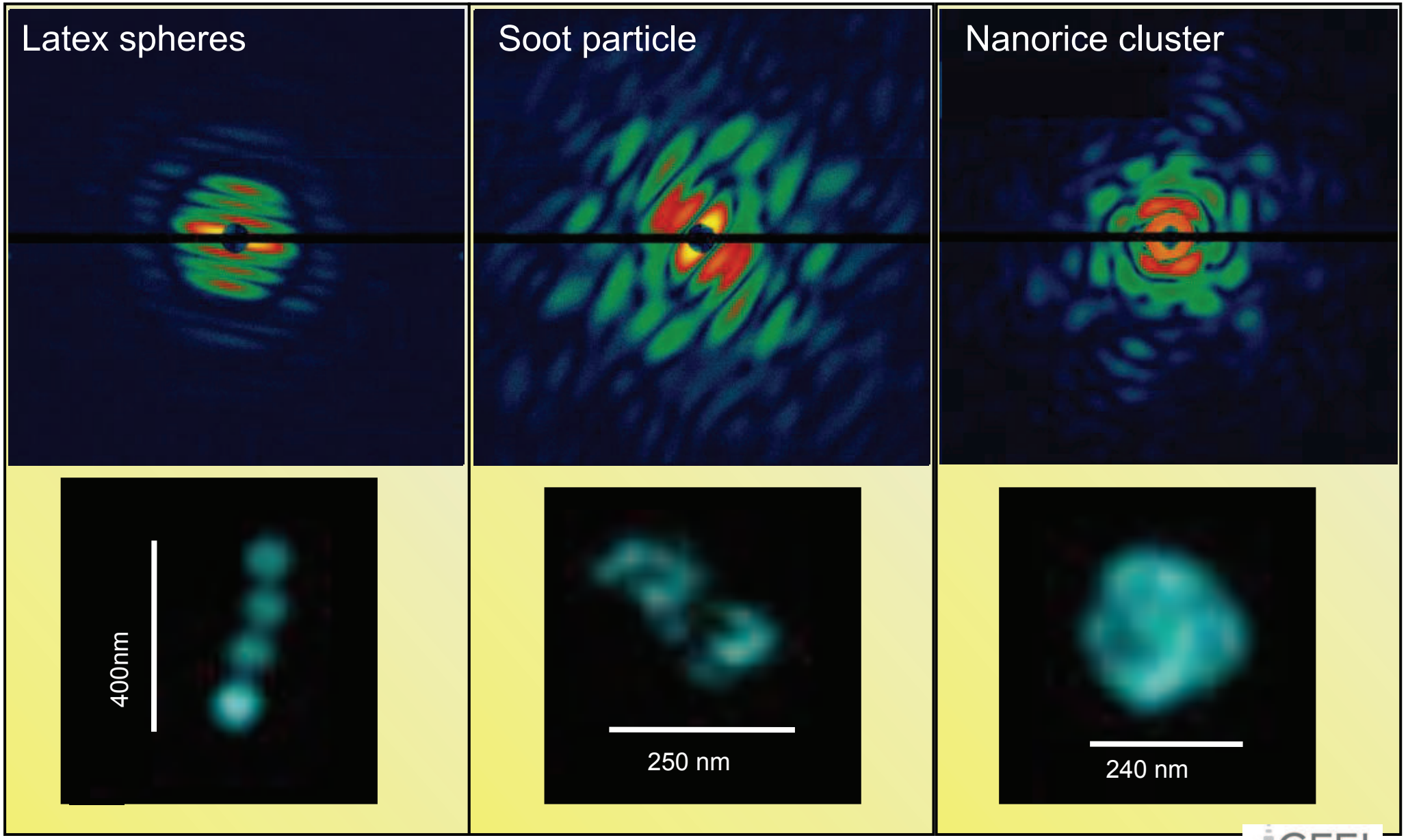
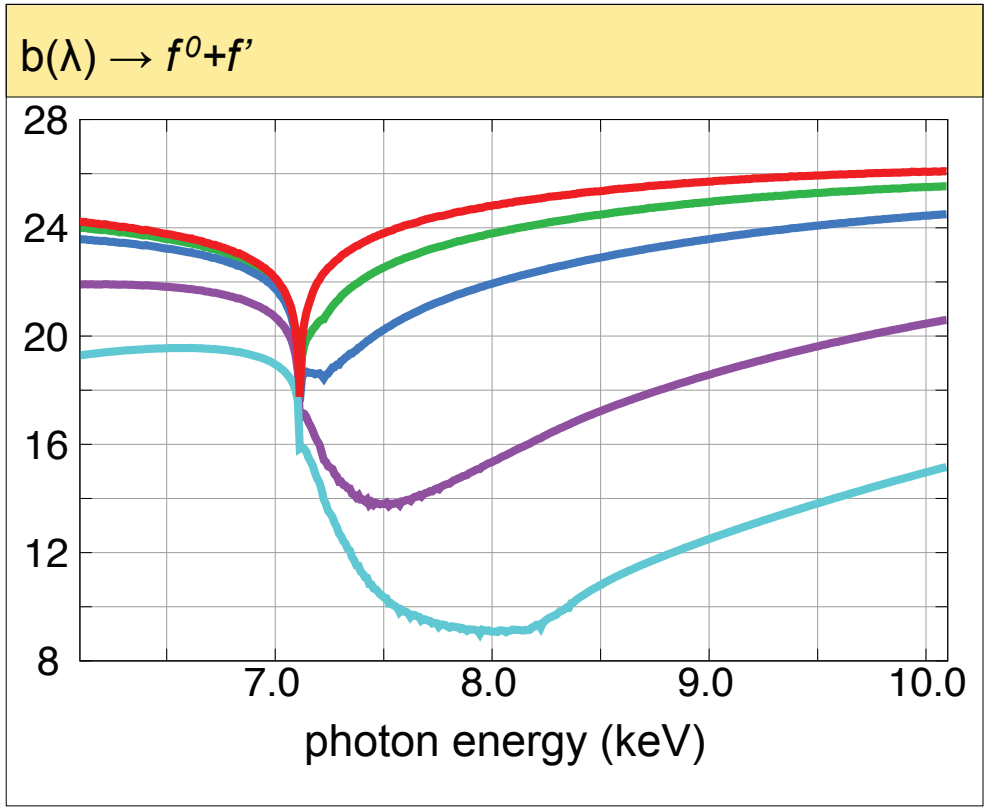
We can reconstruct images of non-periodic particles

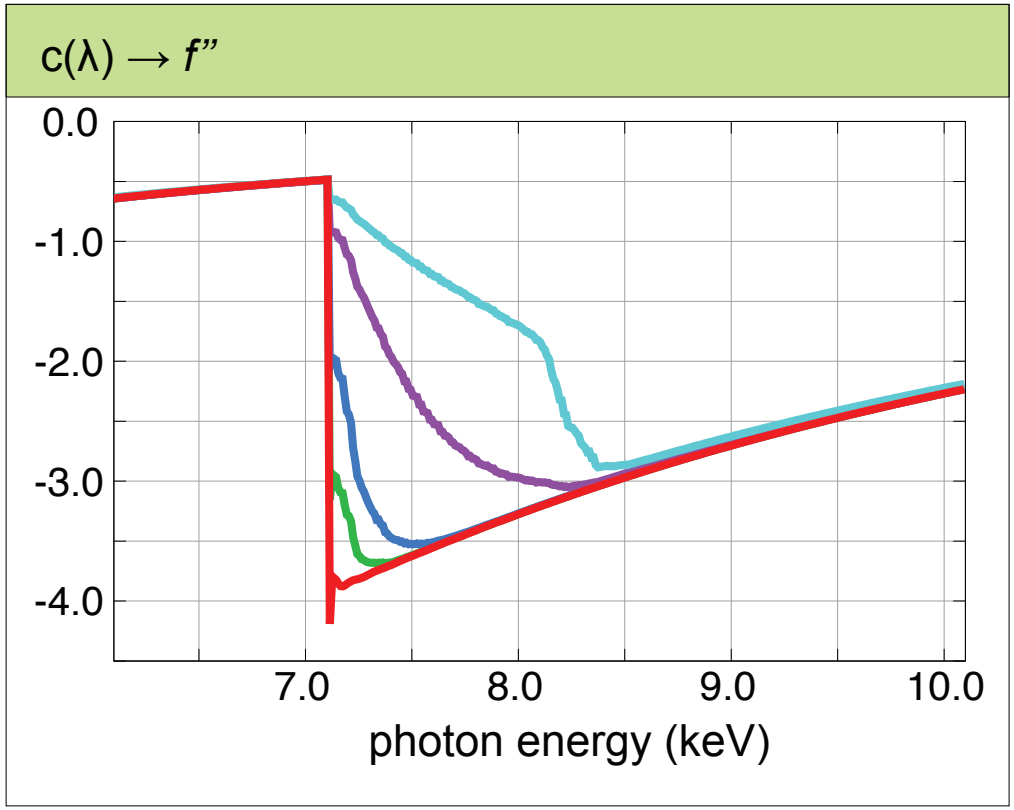


Andrew Martin, CFEL

Calculations show that anomalous signals are enhanced by high X-ray intensity

Effective scattering factors for Fe with 2 mJ pulse
Average ionization by end of pulse is +14 for highest fluence

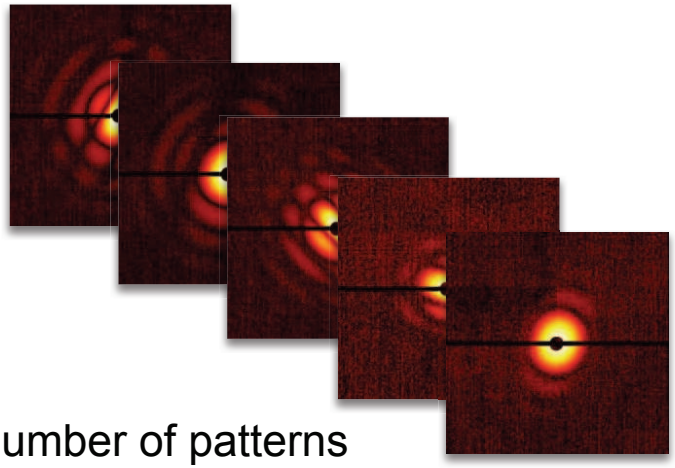




Undamaged	
1.6×10^{17} W/cm^2	1.6 MGy/fs
5×10^{17} W/cm^2	5 MGy/fs
2×10^{18} W/cm^2	20 MGy/fs
2×10^{19} W/cm^2	200 MGy/fs

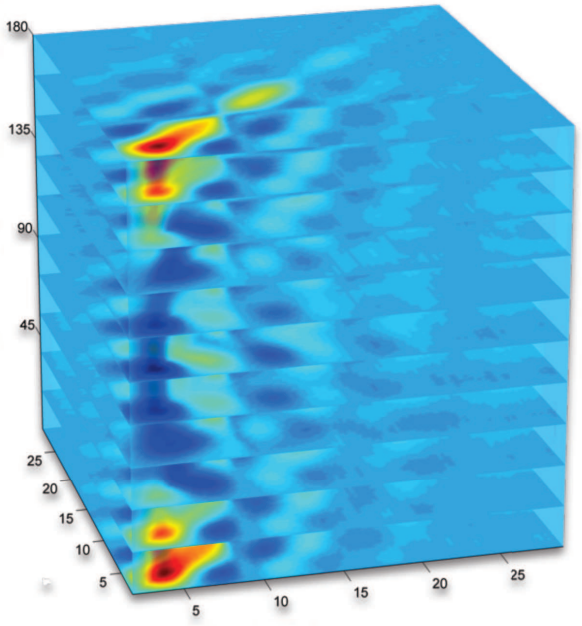
S.-K. Son, H.N.C., R. Santra,
PRL **107**, 218102 (2011).

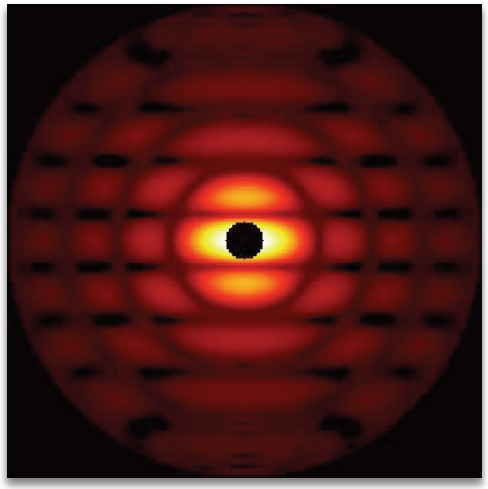
The assembly and orientation problem can be solved by accumulation of self correlation functions



Number of patterns required is proportional to SNR^2

This method can utilize all 30,000 pulses per second, even if the detector can only store 3,000. (Incoherent addition)





Dmitri Starodub

SLAC NATIONAL ACCELERATOR LABORATORY

Opportunities could be tremendous

We should need about 10,000 oriented patterns for a structure

This could be achievable with <100,000 shots (with 10^{10} particles/ml)

The continuous flowing jet consumes about 10 µl/minute

	LCLS at 120 Hz	XFEL at 27,000 pulses/second	XFEL at 3,000 pulses/second
Measurement time	14 minutes	3 seconds	31 seconds
Number of structures per day (1 minute exchange)	96	1370	950
Volume of suspension	140 µl	0.5 µl	5 µl
Amount of protein	1.4 mg	5 µg	50 µg
Amount of protein with pulsed jet	10 µg	0.5 µg	5 µg

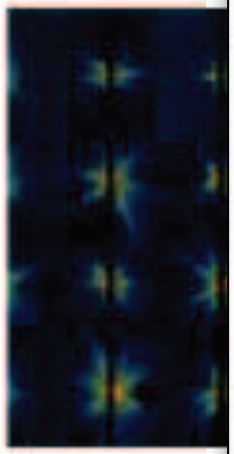
ROYAL SOCIETY

Events Videos Public lectures Scientific meetings Exhibitions Summer Science

X-ray lasers in biology

9:00 am on Monday 14 October 2013 – 5:00 pm on Tuesday 15 October 2013
at The Royal Society, London

➞ Register now



Scientific discussion meeting organised by Professor Henry Chapman and Professor John Spence

Event details

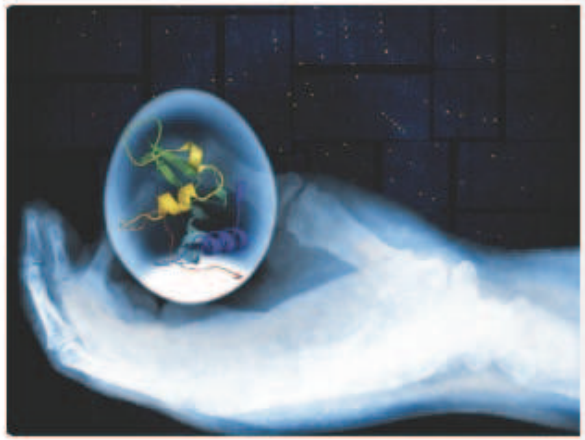
The recent invention of the hard X-ray laser (XFEL) has opened new vistas for structural and dynamic biology. This meeting will review the latest work, outline opportunities for future research, and describe the new techniques (snapshot SAXS, serial nanocrystallography, single-particle imaging) which [illegible] atomic spatial resolution and femtosecond time resolution of the [illegible]

Biographies of the organisers and speakers will be available shor[illegible] also download the programme (PDF). Recorded audio of the p[illegible] available on this page after the event and the papers will be pub[illegible] Philosophical Transactions B.

X-ray lasers in biology - techniques

9:00 am on Wednesday 16 October 2013 – 5:00 pm on Thursday 17 October 2013
at The Royal Society at Chicheley Hall, home of the Kavli Royal Society International Centre, Buckinghamshire

➞ Register now



Satellite meeting organised by Professor John Spence and Professor Henry Chapman

Event details

This meeting brings together leaders in the development of new techniques for the study of molecular structure and interactions in biology using the recently invented hard X-ray laser. Topics will include time-resolved protein nanocrystallography, femtosecond wide-angle X-ray diffraction, sample delivery devices, data analysis and diffraction theory, and detector systems.