The Next 100 Years microsymposium

Chair: Michael Wörle (16.00-18.30 HCI J6)

16:00 (invited talk) **Bruce D. Patterson**
SwissFEL Project, Paul Scherrer Institut, CH-5232 Villigen

Novel Structural Studies with an X-Ray Free Electron Laser

A single focused pulse from an X-ray Free Electron Laser (XFEL) deposits approximately 10^12 Gray (J/kg) in a biological sample – this exceeds by five orders of magnitude the "bio-limit" for protein crystallography and causes the irradiated region (100 x 100 nm^2) to undergo, within 50 femtoseconds, destructive "Coulomb explosion". Of what use is such an X-ray source for crystallography? After a brief description of how an XFEL works, I will in this talk give four examples of novel XFEL applications in the imaging of matter, at or close to the atomic scale:

1) sub-picosecond time-resolved resonant diffraction in correlated electron materials,
2) serial "diffract-and-destroy" protein nano-crystallography,
3) 2D-ptychographic crystallography of membrane proteins, and
4) cross-correlation analysis of scattering by nanostructures in solution.

Finally, I will comment on the "holy grail" of XFEL science – structure determination of individual protein molecules.
The SwissFEL X-ray laser will go into operation at PSI in late 2016.