in Figure 1), which is only possible due to the well-preserved transverse coherence. Measuring intensity fluctuations also reveals that only a single or double temporal modes remain in the beam, indicating the delivery of near Fourier transform limited pulses. We also successfully performed a proof of principle Split Pulse XPCS experiment on a model system of small (R = 1 nm) gold nanoparticles dispersed in hexane solvent with hard x-rays and obtained the first time autocorrelation function in the ns time domain.

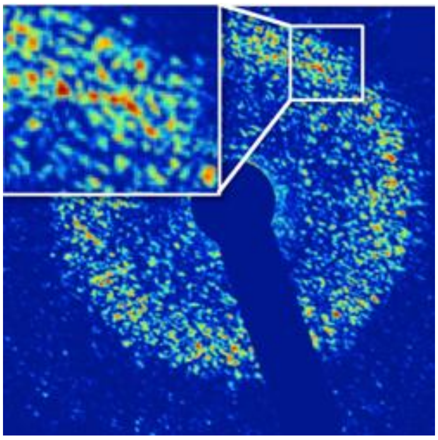

Figure 1. Typical pattern showing randomly oriented speckles.

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L-06 Session A, Tuesday, 14.06., 11^{40} - 12^{20}

Towards compact short wavelength Free Electron Laser using laser plasma acceleration

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More than 50 years after the lasers discovery [1] and more than 30 years after the first Free Electron Laser (FEL) using relativistic electrons in a periodic magnetic field as a gain medium [2], the advent of X-ray free elctrons lasers open new paths for investigation of matter for imaging, ultra-short phenomena for example. The emergence of the femtosecond, high power (typically GW), peak and average brilliance, tunable X-ray FELs constitutes a major scientific revolution, after the one brought by the laser invention. FEL user facilities (FLASH [3], FERMI@ELETTRA in the seeded configure tion [4], LCLS [5] and SACLA [6] in the hard X-ray) enable to harvest new scientific results in unexplored scientific areas. Present X-ray FEL are usually built on linear accelerators of high beam quality, delivering nC charge, with 0.01 % energy spread and 1 µm.rad emittance.

While additional X-ray FEL centers are under construction, new directions are also taken, such as operation at high repetition with multiplexed FEL beamlines with FELs relying on superconducting linear accelerators, advanced seeding, and compactness in considering reducing the size of each constituting components. Besides advanced seeding schemes [7] and compact undulators [8]. Besides, one also considers replacing the conventional linear accelerator by a compact one system relying on an alternative concept, such as dielectric acceleration, inverse FEL and Laser Plasma Acceleration (LPA) [9]. In LPA, a short multi-TW laser pulse in focus in a gas jet (cell, capillary) and drives strong plasma waves in its wake [10, 11] which can drive the electron acceleration to GeV on a mm scale. Synchrotron radiation has been already observed with LPA [12-15]. But the present electron divergence (1 mrad) and energy spread (of the order of 1 %) does not match the present performance of conventional linear accelerators used for short wavelength FELs. In consequence, an adequate beam manipulation through the transport to the undulator is needed for FEL amplification. One first strategy is to use a demixing chicane to sort out the electrons in energy and reduce the slice energy spread by typically one order of magnitude [16, 17]. One can even take advantage of this introduced correlation to focus the electron slices in synchronization with the progress of the optical wave in the undulator for higher effective electronic density [18, 19] in the so-called chromatic matching scheme. An alternative strategy is to use a transverse gradient undulator [20].

Tests experiments will be reviewed, such as the COXINEL one [21].

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L-07 **Session B, Tuesday, 14.06., 9^{00} - 9^{40}**

Structure and long-range-order in colloidal self-assembly

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Colloids are able to self-assemle into various structures with periodicity on the scales ranging from nanometres to about a micron. They are widely recognized as an important model system to study nucleation phenomena in freezing, melting and solid-solid phase transitions, jamming and glass formation. In addition, colloidal crystals are attractive for multiple applications since they can be used as large-scale low-cost templates to fabricate novel materials with unique optical properties such as the full photonic bandgap, 'slow' photons and negative refraction, as well as materials for application in catalysis, biomaterials and sensorics.

Nowadays small-angle X-ray scattering (SAXS) is widely recognised as an indispensable structure characterisation tool at the mesoscopic scales. Recent developments of synchrotron sources and X-ray detectors provide a very fast and effective tool to study colloidal crystals and their real-time development. The high penetration power of X-rays makes SAXS applicable to almost all system types. In addition, the intrinsically low contrast of all materials for X-rays ensures, in the vast majority of cases, a high quality of the scattering data that is free of multiple scattering contributions. SAXS also gives access to a broad range of spatial scales from a nanometre to microns. Moreover, as will be discussed in more detail in the lecture, microradian resolution can be achieved using synchrotron sources and refractive optics [1]. This provides access to periodicities up to several microns. Moreover, positional correlations on distances up to submillimetre can be accessed from the width of diffraction peaks measured with microradian resolution.

The results will be illustrated by a number of examples. In particular, the structure of rhombic crystals spontaneously formed by cubic colloids with rounded corners will be discussed [2,3]. Another example will be the transition to a lower-symmetry body-centred tetragonal structure in a system of magnetic core-shell spherical colloids, which is induced by dipole-dipole interactions between colloids [4]. A short overview of some of our studies of lyotropic colloidal liquid crystals spontaneously formed by highly anisometric colloidal particles [5,6] will be given. Finally, in-situ studies of the self-ogranization of semiconductor quantum dots of different shape