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GPU-accelerated solvers for the ptychographic reconstruction framework PtyPy

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X-ray ptychography has been established as a successful high-resolution imaging technique at synchrotrons and FELs \cite{1}. In recent year, the Diamond Light Source (DLS) has invested significant resources into the development of fast GPU-accelerated reconstruction code for ptychography. Here, we present a comprehensive list of new features added to the already versatile computational framework PtyPy \cite{2} including GPU-accelerated code for the difference map (DM) \cite{3}, maximum likelihood (ML) \cite{4} and other solvers, all with mixed-state \cite{5} capabilities. We demonstrate the achieved speed up in reconstruction time on a large test dataset with 200 000 diffraction patterns, reconstructed with and without position correction using PtyPy (Figure 1). We will further present live streaming capabilities in PtyPy and a new web-based visualisation interface.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure1.png}
\caption{Nano-fabricated test sample from the I14 beamline (DLS) with 200 000 diffraction patterns of size 128x128 pixels reconstructed with the GPU-accelerated PtyPy software using 300 iterations of the DM algorithm (a) without any corrections and (b) with position refinement. Normalised reconstruction times (nanoseconds / iteration / frame / pixel) [6] were achieved at 0.11 (a) and 0.12 (b) respectively.}
\end{figure}

\begin{thebibliography}{9}
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