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X-ray coherent diffractive imaging of quantum vortices in single helium droplets RICO MAYRO TANYAG, CHARLES BERNANDO, CURTIS JONES, LUIS GOMEZ, ANDREY VILESOV, University of Southern California, CAMILA BACELLAR, JAMES CRYAN, KATRIN SIEFERMANN, FELIX STURM, OLIVER GESSNER, Chemical Sciences Division, Lawrence Berkeley National Laboratory, KEN FERGUSON, SEBASTIAN CARRON, SEBASTIAN SCHORB, SLAC National Accelerator Laboratory, CHRISTOPH BOSTEDT, Argonne National Laboratory, LARS ENGLERT, Carl von Ossietzky University of Oldenburg, DENIS ANIELSKI, LUTZ FOUCAR, Max Planck Advanced Study Group at CFEL, JOACHIM ULLRICH, Physikalisch-Technische Bundesanstalt, DANIEL ROLLES, ARTEM RUDENKO, Kansas State University — Free, single, rotating superfluid ^{4}He nanodroplets (diameter D = 200 - 2000 nm, temperature T = 0.4 K) containing a number of quantum vortices have been studied via ultrafast X-ray coherent diffraction imaging using a free electron laser. The droplets were doped with Xe atoms, which collect on the vortex cores and serve as a contrast agent. In order to obtain the instantaneous positions and shapes of the vortices from the diffraction images, a phase retrieval technique has been developed, which utilizes the droplet boundary as a physical support. The algorithm also uses the droplet's scattering phase as an input for the iterative phase reconstruction. The obtained reconstructions reveal a plethora of transient vortex configurations within the droplet. The details of the algorithm and the possible origin of the observed vortex configuration will be discussed.

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