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Synchrotron x-ray ultrafast x-ray imaging on dynamic multiphase flow studies YUJIE WANG, KAMEL FEZZAA, JIN WANG, KYOUNG-SU IM, Argonne National Laboratory — To overcome the long-exposure time of x-ray imaging for liquid systems. In the past year, we have developed the first ultrafast white-beam synchrotron x-ray phase-contrast imaging technique in the world. With its unprecedented temporal (0.5 μs) and spatial resolutions (1 μm), this new technique has already shown great promises in the study of complex fluid mechanical systems. It can probe complex surface morphology and transient dynamics of these interfaces of fluid mechanical systems without the nuisance of multiple scattering. This technique is a big step forward in comparison to millisecond-temporal and micrometer-spatial imaging resolutions normally achieved at various synchrotron sources. With the development of this new technique, we can already carry out research in fluid mechanical systems in competition with world-leading research groups. Our study of the primary breakup process of a coaxial air-assisted liquid jet revealed that the dynamics is dominated by a "liquid membrane breakup" process instead of a simple "ligament mediated breakup" process owing to our far superior temporal and spatial resolutions. This observation will naturally lead to a cascade idea for the unified treatment of liquid jets, droplets, and liquid membranes breakup mechanism.

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