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Novel X-ray Light Sources

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For over 100 years X-rays have been our most important probe of atomic and molecular structure due to their angstrom-scale wavelength. With the advent of powerful synchrotrons in the late 20th century, x-ray beams became a billion times brighter than the small lab-based sources that had existed previously. Then 5 years ago, with the advent of x-ray free-electron lasers (XFFELs), the beam brightness increased by another factor of a billion. I will discuss the performance of these extraordinary sources and the science they enable. While these powerful accelerator facilities produce superb science, they are large and expensive with only a few in the world. However new laser and accelerator technologies are on the cusp of x-ray production that retains the performance of the large facilities while shrinking their size to a university scale lab. I will discuss RD into these new laser-based x-ray sources.