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The 4th Generation Light Source at Jefferson Lab.¹

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Over the last 40 years the peak brightness of new synchrotron radiation sources has increased on average by an order of magnitude every 24 months!! By comparison, Moore's Law states that the number of transistors on an integrated circuit "only" doubles every 24 months. This talk will report on the physics and enabling technology of the latest round of brightness improvements, which have been achieved in the IR and THz range at Jefferson Lab but whose principles are extendable to light sources at shorter (uv to x-ray) wavelengths. Examples of scientific applications will also be given. The JLab facility is based on an Energy Recovered Linac (ERL),¹ rather than a storage ring. The power is then enhanced by multiparticle coherent effects,² while the source size is smaller because the horizontal emittance is approximately equal to the vertical emittance (round beams). In addition the bunch lengths are in the 100's of femtosecond range, allowing ultrafast phenomena to be studied. Finally, unlike conventional linac-based machines an ERL can operate continuously. ¹G.R. Neil et al, Phys. Rev. Let. 84, 662 (2000). ²C. J. Hirschmugl, et al, Physical Review A44, 1316, (1991).

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