Compact all-optical precision-tunable narrowband hard Compton X-ray source

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Readily available bright X-ray beams with narrow bandwidth and tunable energy promise to unlock novel developments in a wide range of applications. Among emerging alternatives to large-scale and costly present-day radiation sources which severely restrict the availability of such beams, compact laser-plasma-accelerator-driven inverse Compton scattering sources show great potential. However, these sources are currently limited to tens of percent bandwidths, unacceptably large for many applications. Active plasma lenses, compact, high-strength electron focussing optics, can be used to tailor the electron bunch-photon interaction, producing tunable X-ray and gamma beams with percent-level bandwidths. The central energy of the X-ray beam is tunable without any moving parts, allowing for precision-tuning the X-ray beam energy. I will discuss the physics of the bandwidth limitation and tuning mechanisms of the X-ray source along with potential applications for this novel X-ray source.