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BESTIA - the next-generation ultra-fast CO2 laser for advanced accelerator research

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Strong-field research will benefit from ultrafast(3-10 cycles), relativistically intense (a0»1), long wavelength (»1um) lasers. The enhanced plasma response mainly manifested through a quadratic wavelength scaling of the ponderomotive energy and the critical density is deemed especially favorable for advanced laser plasma accelerators.
A next-generation mid-IR laser project is under construction at the BNL ATF as a part of the user facility upgrade. We discuss our innovative approach to this new 100-TW, 100-fs,9÷10um CO2 laser BESTIA (Brookhaven Experimental Supra-Terawatt Infrared at ATF). Progress made recently, including chirped pulse amplification, already led to increase in the laser power delivered to ATF users'experiments.
BESTIA will enable new regimes in the acceleration of ions and electrons. In tenuous plasmas, it will be capable to generate plasma "bubbles"thousand times bigger in volume compared to those produced with near-IR solid state lasers of equivalent power. This wavelength scaling will facilitate the study of external seeding and staging of Laser Wake Field Accelerators.
Another example is the shock-wave ion acceleration from over-critical gas jets. At its full power, BESTIA should produce quasi-monoenergetic beams of protons at 200 MeV energy.

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