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## Swift ion bunch acceleration by high power laser pulses

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For approximately the last 20 years, laser-driven acceleration of ions has inspired novel applications that can benefit from interesting ion bunch properties. Those contrast conventional (non-laser based) accelerators by extremely short pulse durations in the picosecond range [1], a broad energy spectrum ( $\sim 100\%$ ), a high peak current ( $\sim \text{kA}$ ) and a small, micrometer source size [2]. The main focus of research has been concentrating on the physics of the interaction of intense laser pulses with plasmas and the related mechanisms of ion acceleration, which I will review in this contribution.

Special emphasis will be laid on the status and prospects of laser-driven ion acceleration in the emerging Petawatt-Laser era. Our group at the Ludwig-Maximilians University Munich is involved in the construction and commissioning of the Center for Advanced Laser Applications (CALA) [3] at the research campus in Garching near Munich. CALA will host one of the highest-power lasers in the world: the ATLAS 3000 laser system. It will be capable to provide a laser energy of up to 60 J in a pulse duration down to 20 fs, offering a peak power of 3000 Terawatts, which will be focused down to a few micrometer diameter. The high repetition rate of 1 Hz is beneficial for the development of enabling technology for future applications.

The anticipated, high laser power promises a multitude of research possibilities, including developments towards radiation therapy of tumours, but also imminent applications which benefit from the unique features of laser-driven ion sources. One prime example, relies on the availability of heavy ion bunches such as gold, lead or thorium with solid-state-like densities for applications in non-linear nuclear physics in fission-fusion reactions to study the origin of heavy elements in the universe [4].

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### References

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