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Spin-polarized beams from plasma-based accelerators and prospects for nuclear fusion

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In recent years, sources of polarized beams from laser-plasma interaction have gained significant interest in the accelerator community [1]. Possible applications of such beams range from basic research, e.g. deep-inelastic scattering, to enhanced energy production in fusion reactors. It was shown by Kulsrud et al. that in the case of the reaction $d + t \rightarrow \alpha + n$, the cross-section is increased by a factor of 1.5 [2]. Similar enhancements are expected for other reactions like proton-Boron fusion.
In this talk, we present the state-of-the-art for polarized beams from plasma-based accelerators. In particular, we discuss recent theoretical results like the acceleration of polarized Helium-3 using Laguerre-Gaussian laser pulses as well as the first successful acceleration of polarized beams using the PHELIX laser system [3].

[1] L. Reichwein et al., *arXiv:2411.11621* (2024)
[2] R. M. Kulsrud et al., *Phys. Rev. Lett.* **49**, 1248 (1982)
[3] C. Zheng et al., *arXiv:2310.04184v2* (2024)

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