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Highly spin polarized electron and positron beams at a compact accelerator facility[1]

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Over the past 30 years polarized electron and positron beams with rather high energies (above 1 GeV) have been demonstrated at large scale particle accelerators world-wide. Proposed future linear colliders aim for even higher energies, colliding beams of polarized electrons and positrons above 100 GeV. However, highly polarized electron and positron beams are not limited to only the large scale facilities, but are equally accessible to the compact accelerator facility operating at the MeV energy scale. Notably, the workhorse method for providing polarized electron beams, via photoemission from GaAs semi-conductors, occurs within a high voltage photo-gun which operates at relatively low accelerating voltage (less than 200 kV) and is often connected to an adjacent low-energy beamline composed of spin rotators to set the polarized beam direction, well suited to a compact footprint. Additionally, polarized electron beams accelerated to MeV energy have been demonstrated to be an efficient method to produce highly spin polarized positrons, via the electro-magnetic shower of the polarized electron beam when interacting with a suitably high-Z target. In this presentation I will review the progress and present-day capability and technology of polarized GaAs photo-guns and discuss the development of an MeV energy polarized positron beam source at Jefferson Lab. Examples of interesting physics experiments using polarized electron and positron beams at compact accelerator facilities will be highlighted.

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