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New methods to produce polarized 3He ion beams

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The use of polarized ^{3}He ions in storage rings opens a new window to investigate nuclear forces, because nuclear polarized ^{3}He ions can be regarded as an ideal substitute for polarized neutron beams. Polarized $^3He^{2+}$ ions were used in the 1960's, but either the nuclear polarization or the intensity of the ion sources was rather small. Numerous efforts to improve the performance of these sources have so far been unsuccessful.

I will present two new methods for producing polarized ^{3}He beams: the first uses a pre-polarized ^{3}He gas target from which few-MeV $^3He^{1+,2+}$ ions are accelerated with petawatt laser pulses. Data from the Phelix facility show for the first time a polarization signal that confirms numerous theoretical works predicting the potential of plasma-based accelerators to produce polarized beams (electrons, protons, and ions). Our data also support the concept of "Polarized Fuel"to increase the efficiency of future fusion reactors. The second method is based on a Sona transition unit, in which an intense beam of few-keV $^3He^{1+}$ ions can be polarized up to $P \sim 90\%$ by means of a coherent and monochromatic radio-wave pulse. A status report on a first beam time at COSY-Jülich (Sept. 2023) will be given.

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