

## The COSY Facility at Jülich: New Accelerator Design and Possible Applications

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During the past 20 years, the Cooler Synchrotron COSY of the Research Center Jülich provided polarized proton and deuteron beams up to energies of 2.88 GeV. Collaborations like COSY11, ANKE, WASA, PAX and TOF used its unique features like phase-space cooled beams of small emittance and polarized internal targets. Based on this experience several new projects are presently being developed:

- 1.) The JEDI collaboration is working on the design of a new type of a primarily electrostatic storage ring to measure the electric dipole moments (EDM) of protons and deuterons with an extraordinary precision. This technique will allow reducing the running costs of a storage ring in the energy range of several 100 MeV, thereby opening a window into new physics beyond the standard model, with the potential to explain the dominance of matter over antimatter in our universe. In addition, in order to achieve the required precision, novel beam diagnostic tools based on SQUIDs and Laser Compton backscattering are required.
- 2.) The proposed Jülich Short-Pulsed Particle and Radiation Center (JuSPARC) will be an interdisciplinary center for collaborative research with ultra-short pulsed photons as well as fast or thermal neutrons and polarized MeV-ion beams. These beams, which can be used for condensed matter physics, material science, structural biology and plasma/fusion physics, will be generated employing the radiation from a high-power (up to few Petawatts, i.e. 10<sup>15</sup> W), short-pulse laser (pulse durations in the 10 fs range). In combination with the COSY accelerator the Laser-accelerated (polarized) beams can be employed for nuclear physics experiments.
- 3.) If the spins of the fuel particles in nuclear fusion are aligned parallel the cross section is increased by a factor of 1.5. This effect can be used to increase the energy output of a fusion reactor by at least a factor of two. In addition, the design of a fusion reactor might be simplified, because the choice of the nuclear spins allows one to control the neutron trajectories. But before polarization is an option to optimize the efficiency of a fusion power station a long list of questions must be answered.

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