

## Review on the Project

### **“A study of the nucleon spin structure in strong and electromagnetic interactions” (SPASCHARM & GDH & NN)**

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The Project includes the programs of research directed to investigation of the spin structure of nucleon at three different laboratories, IHEP (Protvino, Russia), IKP (Mainz, Germany) and CTU (Prague, Czech Republic). The experiments require the use of polarized targets with frozen spin, which are being developed by JINR physicists from the Low Temperature Sector of the LNP.

The SPASCHARM part, which is realizing at IHEP (Protvino) with the use of unpolarized and polarized hadron beams of U-70 and a modernized polarized proton target developed at JINR, proposes a study of single and double-spin asymmetry in light particles and charmonium production. Investigation of different exclusive and inclusive reactions with polarized target at good statistics will allow to estimate quark flavor effects and to solve the problem of gluon contribution to the nucleon spin at rather high  $x$ -values (0.3-0.6). Measurements of spin effects in charmonium production in hadron interactions will be the first ones. The development of antiproton beam opens new possibilities. Owing to the high statistics they will allow to see the contributions of different processes to the charmonium production mechanism. The new polarizing magnet with high homogeneity has been developed and tested. A transistor with quartz oscillator with output power 400 mW at a frequency of 67 GHz has been developed for the dynamic build-up of polarization.

The GDH program includes double-polarization experiments at beams of tagged polarized photons of Mainz Microtron in the whole energy region from 0.2 GeV up to maximum energy of 1.5 GeV (MAMI C). The GDH part of the Project is planned to be fulfilled at the Institute of Nuclear Physics (IKP) in Mainz. In these experiments the new frozen spin polarized target is used. The  $^3\text{He}/^4\text{He}$  dilution refrigerator, as the most important part of the target facility, has been designed and constructed by the JINR. Horizontal geometry of the cryostat and the use of thin internal superconducting coils for supporting the frozen polarization (longitudinal and transverse) allows to place the target inside the  $4\pi$  Crystal Ball detector. The good working parameters of the refrigerator (base temperature 30 mK, proton polarization over 90%, deuteron polarization up to 80%, polarization relaxation time more than 2000 hours) ensure very effective data acquisition. New insert based on a new principle which was developed by the JINR group makes the operation of the target easy and convenient. In addition, on the proposal of A2 collaboration JINR scientists have developed an “active” polarized target using solid-state scintillated films as a working substance of the target and firstly in the world have measured the spin polarizabilities of the proton.

The spin dependence of the total photoabsorption and meson photo-production processes on proton and deuterons are the main goals of the GDH part of the Project. The important role in the theoretical support is provided by S.B.Gerasimov who is the