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Production of Hyperpolarized 3He Gas for Medical Imaging

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Polarized ion sources and targets have been developed at RCNP, Osaka University. Based on this experience, we started the project of hyperpolarized nuclei for medical imaging with 3He and 19F by the brute force and PHIP (Parahydrogen Induced Polarization) methods, respectively [1]. Here, the latest development on the 3He hyperpolarization is presented, whereas the other parts will also be presented in this workshop by our collaborators.
We expect to produce hyper-polarized 3He gas by first growing polarized solid in a Pomeranchuck cell, in a 17T field [2] and then subsequently rapidly melting it [3,4] thus creating strongly polarized liquid that we will let evaporate from the cell, thus hopefully creating polarized 3He gas.
To meet this prerequisite, a Pomeranchuk cell, in which 3He itself works as refrigerant, is mounted on the DRS2500 (Leiden Cryogenics), 3He/4He dilution refrigerator. The cell is positioned in the center of the 17T-71 (JASTEC), superconducting solenoidal coil. Performance of the piston type Pomeranchuk cell was improved by replacing it with a
plastic cell with a capton (DuPont-Toray) membrane and sintered silver rod. For monitoring the 3He pressure precisely, a sapphire pressure gauge [5] was used in the 3He cell.
Another great improvement was done for observation of the proton NMR signals at 17 T with a digital NMR spectrometer employing the high frequency (GHz region) PXI modules commercially available recently. For this purpose, our previous NMR spectrometer working at 1 T [6] was revised. This new NMR spectrometer will hopefully be a direct
polarization monitor at 17 T, the detail of which will be presented in this workshop by our group.

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