

Development of a ^3He -hydraulic actuator for spin pump in superfluid $^3\text{He-A}_1$

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The superfluid $^3\text{He A}_1$ phase contains a spin-polarized condensate. This property allows novel superfluid spin current experiments. In the mechano-spin effect (MSE) of the A_1 phase a mechanically applied pressure gradient and a superleak-spin filter enable to directly boost spin polarization of ^3He in a small chamber. Using a flexible membrane as an electrostatically actuated pump, we carried out such MSE experiments and observed 50% enhancement of spin density in a chamber¹. We are currently developing a new ^3He -hydraulic actuator for achieving greater enhancement of spin density. The actuator consists of two liquid ^3He chambers located at a 4.2 K plate and in the interior of the cell. The pressure in the 4.2 K chamber is heater-controlled and it transmits a force onto a membrane in the cell. The motion of the membrane induces spin-polarized current into an accumulation chamber. The details of the apparatus and the latest results using the new actuator and facilities of ISSP, Univ. Tokyo, are presented.

¹A. Yamaguchi, Y. Aoki, S. Murakawa, H. Ishimoto, and H. Kojima, Phys. Rev. B 80, 052507 (2009).