π-Contact Interferometry Based on Ultracold Fermionic Atomic Gases

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Abstract. The BCS pairing between hyperfine states of ultracold fermionic atomic gases (UCFAG) with the mismatch in chemical potentials ($\delta\mu_N \neq 0$) is studied in the framework of the theory of pairing in multicomponent systems proposed in 1991 [1]. It turns out that the latter theory is useful in studying of novel effects due to the compensation of various chemical potentials (related to quantum numbers of pairing species) in layered superconductors and in quark matter where color superconductivity is realized.

In the talk will be discussed a possibility for the realization of the S/N/S π-Josephson contact in UCFAG systems where the left and right banks S are superfluids and the weak link N is the gas in the normal state with the finite mismatch in chemical potentials $\delta\mu_N \neq 0$. If such a π-junction is part of a closed superfluid ring - the ultracold atomic π-SQUID, the superfluid mass-current flows spontaneously (and breaks the time reversal symmetry) if the radius of the ring is larger than the critical one. The same effect is expected to be realized also for $\delta\mu_N >> \Delta$, where Δ is the superfluid gap in S. Possible realization of the π-SQUID and its application for sensitive measuring of rotations and gravitational fields are discussed.

If the S/N/S junctions and trilayer heterostructures $N_1/S/N_2$ can be realized on UCFAG, this would open a way for novel devices based on hyperfine atomic states - hypertronics.

REFERENCES

1. M. L. Kulić, U. Hofmann, *Sol. St. Comm* **77**, 717 (1991).