Spinor quantum gases with narrow-line control

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Degenerate atomic gases provide a new realization of magnetic systems, which permit to revisit questions encountered in condensed matter, while providing access to a new range of physical situations. Alkali-earth species combine the attractive properties of large-spin fermionic isotopes, and of narrow spectroscopic lines commonly used in the context of metrology. Our project aims at taking full advantage of the spectroscopic properties of Strontium 87 to study the many-body physics of a 10-component spinor fermionic gas in lattice geometry [1]. The 7 kHz wide ${}^1S_0 \rightarrow {}^3P_1$ transition will be used for site- and spin-selective state transfer and detection. The mHz wide "clock" transition ${}^1S_0 \rightarrow {}^3P_0$ offers prospects for the optical control of interactions and for the preparation of metastable magnetic impurities [2]. The optical frequency reference from the optical clocks at Observatoire de Paris, disseminated to Laboratoire de Physique des Lasers through a fiberized link [3], will permit to assess the frequency stability of the laser sources involved in narrow-line control of this many-body system.

References

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