

From paired super-radiance to neutrino mass spectroscopy using atoms

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We present some preliminary results of our experiment which aims to prove the principle of the “macro-coherent amplification mechanism”, a new amplification mechanism which exploits coherence of particles involved in de-excitation processes.

When this mechanism is in operation, decay rates, such as emission of neutrino-pair and photon from excited atoms, become proportional to N^2 (not to N), where N is the number of excited atoms in a coherent volume. Unlike Dicke’s super-radiance, which is also a coherent phenomenon (and thus $\propto N^2$), its coherence volume can be made macroscopic when a certain phase matching condition is satisfied among the outgoing particles. Our ultimate goal is to use this mechanism for investigating neutrino properties: determination of the absolute mass scale, Dirac/Majorana distinction, and measurement of Majorana phases, among others.

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