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Laser Trapping of Radioactive Atoms[1]

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Stuart Freedman conceived the idea of laser trapping radioactive atoms for the purpose of studying beta correlation effects. "This is really the theorist's view of a radioactive source," as he fondly claimed. It is ideal because the atoms form a point source, compressed in both position and momentum space, with no material walls nearby. The Berkeley group succeeded in trapping ^{21}Na (half-life = 22 s) atoms [Lu et al., PRL 72, 3791 (1994)], and determined its beta-neutrino correlation coefficient $a = 0.5502(60)$ to be in agreement with the Standard Model [Vetter et al., PRC 77, 035502 (2008)]. Other groups have joined this effort with searches for scalar or tensor couplings in the weak interaction. Moreover, the technique has been extended to trap very short lived ^{8}He (0.1 s) to study its halo structure or the very long lived ^{81}Kr (230,000 yr) to map the movement of groundwater.

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