Lattice Energy LLC

New possibilities for developing minimal mass, extremely sensitive, collective many-body, quantum mechanical neutrino 'antennas'

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Technical references:

Peer-reviewed:

"*Perturbation of nuclear decay rates during the solar flare of 13 December 2006*," J. Jenkins and E. Fischbach, *Astroparticle Physics* **31** pp. 407 - 411 (2009)
http://arxiv.org/ftp/arxiv/papers/0808/0808.3156.pdf

"*A primer for electroweak induced low-energy nuclear reac*tions," Y. N. Srivastava, A. Widom, and L. Larsen, *Pramana - Journal of Physics* **75** (4) pp. 617 – 637 (2010)
http://www.ias.ac.in/pramana/v75/p617/fulltext.pdf

Not peer-reviewed:

"Claimed observations of variations in rates of nuclear β-decay; Evidence for dynamic behavior of nuclei responding to their immediate physical environment?"
Lewis Larsen, Lattice Energy LLC, June 3, 2011 [88 slides - Jenkins & Fischbach's paper also discussed]
http://www.slideshare.net/lewisglarsen/lattice-energy-llc-changes-in-solar-neutrino-fluxes-alter-nuclear-betadecay-rates-on-earthjune-3-2011

"Nucleosynthetic networks beginning with Nickel 'seed' nuclei, why cascades of fast beta-decays are important, and why end-products of LENR networks are mostly stable isotopes"
Lewis Larsen, Lattice Energy LLC, March 24, 2011 [25 slides --- see especially Slides #6 - 8]
http://www.slideshare.net/lewisglarsen/lattice-energy-llcnickel-seed-wl-lenr-nucleosynthetic-networkmarch-24-2011

State-of-the-art using neutrino emissions to detect locations of fission reactors:

Please see the following preprints and PowerPoint conference presentations:

http://arxiv.org/PS_cache/arxiv/pdf/1011/1011.3850v1.pdf

http://aap2011.in2p3.fr/Program_files/SNIF-IAEA2011_T.Lasserre.pdf

http://arxiv.org/PS_cache/arxiv/pdf/1101/1101.2755v4.pdf

http://aap2011.in2p3.fr/Program_files/lasserre_AAP2011_RAA.pdf

Lattice's speculative theoretical conjectures about the behavior of beta-unstable nuclei:

Please imagine that a neutron-rich nucleus unstable to beta-decay behaves dynamically as if it were a collective, many-body quantum system that continuously 'senses' or 'interrogates' what is present in its nearby local continuum (immediate physical environment) through nuclear decay channels that are quantum mechanically connected (via local entanglement) to the 'outside' world (the local continuum).

In effect, such unstable nuclei must perform a rudimentary form of dynamic quantum computation in order to be able to 'decide' exactly when they can move toward a lower-energy entropic state, i.e. decay, given the possible presence of local temporal constraints on decay, e.g., fermionic decay 'frustration' that results from operation of the well-known Pauli Exclusion Principle.

To clarify: this so-called fermionic 'frustration' may occur when a given nucleus is temporarily unable to beta decay at a particular instant in time because a fermion, that is, an antineutrino and/or an energetic electron, is/are both physically present nearby within the "local continuum" and are in effectively the same quantum state as the aborning decay product(s). In order to finally decay, such a nucleus must simply 'wait in limbo' until an unoccupied 'slot' opens-up in the local continuum; hence it must 'monitor' status of the outside world through its Q-M decay channel 'sensors' in order to 'know' when it is OK to do so.

Key theoretical question: for Q-M nuclear 'decision making' purposes, how do we know exactly where a beta-unstable nucleus' "local continuum" effectively begins and ends? Does it begin at the quantum mechanically 'fuzzy' outer boundaries of the atomic nucleus proper? Or does it really begin much further out and away from the minuscule nucleus itself --- say just beyond the fuzzy quantum mechanical boundaries of the very last occupied outer (valence) electron shell? Or does it begin even further away from a given unstable atom?

Jenkins & Fischbach's published experimental data appears consistent with conjectures:

About 99.99% of ^{54}Mn atoms decay (half-life ~312 days) via K-shell electron capture, which involves the weak interaction as follows: $^{54}Mn + e \rightarrow {}^{54}Cr + \nu_e$. Recall that neutrinos obey Fermi-Dirac statistics (they behave like Fermions); given that constraint, in order to successfully decay, a ^{54}Mn nucleus must be able to emit an electron neutrino (ν_e) into an unoccupied fermionic state in the local continuum. If all such local states are momentarily filled, a given nucleus cannot decay until an unoccupied 'slot' opens-up. Now imagine a ^{54}Mn atom located on earth bathed in a more-or-less steady-state, 'bright' flux of electron neutrinos coming from the direction of the Sun. At every instant, unstable ^{54}Mn atoms are quantum mechanically interrogating the local continuum 'world' outside the nuclei via the electron capture channel in order to 'decide' whether it is permissible to decay by emitting a neutrino. In doing so, a given ^{54}Mn atom's internal 'nuclear decay clock' is effectively modified by changes in fine details of 'nearby' external neutrino fluxes in terms of experimentally observed decay rates of such atoms.

For example, imagine that a very large flare occurred on the Sun in which copious weak interactions $e^- + p^+ \rightarrow lepton + X$ took place via the Widom-Larsen many-body collective magnetic mechanism. Further suppose that the energy spectrum of such a 'bright' burst of electron neutrinos emitted from the specific flare that occurred during their experiment strongly overlapped the normal spectrum emitted by ^{54}Mn nuclei. In that event, one might expect that a measurable temporary decrease would occur in the decay rates of ^{54}Mn nuclei in a macroscopic sample being monitored experimentally on earth. *In fact, this occurred in Jenkins & Fischbach's ^{54}Mn sample. This result suggests that the Widom-Larsen collective magnetic mechanism could have operated in the large solar flare that was temporally coincident with the statistically significant perturbations in the ^{54}Mn nuclear decay rate observed by Jenkins & Fischbach.*

Importantly, Jenkins & Fischbach's experimental data on ^{54}Mn allows has enabled them to work *backwards* and calculate an estimated effective interaction cross-section of electron neutrinos coming from $e- + p^+ \rightarrow lepton + X$ reactions in the solar flare (which are predicted by W-L theory published in *Pramana*) impinging ^{54}Mn atoms present in their measured sample of ^{54}Mn over the time interval of the measurements. The apparent cross-section that emerges from their straightforward calculation is on the order of ~10^9 - 10^{10} times larger than what one would expect with 'normal' interactions between neutrinos and atomic nuclei. *How can one explain this unexpected and deeply anomalous result?*

If the above-explained theoretical conjectures were true, and if the "local continuum" that ^{54}Mn nuclei exposed to a distant electron neutrino point source (located in the co-temporal solar flare) 'see' really begins just a little ways beyond the fuzzy quantum mechanical boundaries of a ^{54}Mn atom's very last occupied outer (valence) electron shell (i.e., the entire ^{54}Mn atom), then one might consequently expect that the value of the cross-sectional area (πr^2) of the entire ^{54}Mn atom divided by the cross-sectional area (πr^2) occupied by a ^{54}Mn nucleus should be about the same magnitude as the anomalously high neutrino interaction cross-section suggested by Jenkins & Fischbach's experimental data. *That is in fact the case: amazingly, both numerical values are very similar at 10^9 - 10^{10}. It is unlikely that this is just a coincidence.*

Implications if experimental data and Lattice conjectures are validated by further work:

Widom-Larsen theory and Jenkins & Fischbach's experimental data suggest that weak-interaction-based detection devices could potentially be designed and built to function as passive, many-body, collective quantum mechanical neutrino 'antennae' with very high neutrino interaction efficiencies, as well as high directional sensitivity and energetic specificity to neutrino fluxes emitted from distant point sources (in theory, more sensitive than existing neutrino detectors by a factor of ~10^9 - 10^{10}). This could potentially be a game-changer in the technological ability to monitor neutrino fluxes of interest in the context of WMD and nuclear proliferation issues, as well as basic science research such as measuring solar neutrinos.

Intriguing and possibly important practical applications for this detection technology:

If prototype detectors based on these new insights can successfully 'image' fixed, land-based fission reactors in preliminary experiments, then with further development it would seem possible that one might eventually be able to successfully detect the locations of moving neutrino sources located anywhere in the near-earth environment. Techniques to estimate neutrino spectral 'signatures' for various types of fission reactors have already been developed; some such signatures have also been measured.

If these new types of Q-M-based neutrino detection and measurement systems finally achieved satisfactory sensitivity/reliability and were practical and cost-effective to engineer, and since such Q-M neutrino antennas could likely be ultra compact and relatively low-mass, they could potentially be deployed on various types of mobile platforms to mitigate global nuclear proliferation risks by identifying and locating undeclared or clandestine fission reactors.

Extremely large fixed installations at underground sites could collect and measure neutrino data that might help improve our understanding of nuclear processes operating in and around the sun, as well as perhaps provide the first lineaments of future neutrino telescopes that might eventually be sensitive enough to resolve 'neutrino images' of nearby stars and examine other objects of interest in our galaxy.

POCs for further questions:

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