Understanding LENR Using QST

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Quantum Spring Theory (QST) is a paradigm shift in physics stemming from the observation that we know a lot more today than was known 100 years ago when first attempting to explain the unexpected behaviours observed at subatomic scale. At the time the conclusion was that normal physics did not apply at subatomic scale. QST maintains that normal physics does apply at subatomic scale; it is space that has properties but which are only observable at that scale. In particular the effect of creating a particle places stress on the surrounding space, a concept explored initially in [1].

If correct, the importance of the realization that classical physics applies at subatomic scale cannot be underestimated. It removes the need for a theory of nuclear interaction which is independent of the rest of physics, laying the foundation for a unification of physics not previously possible. Suddenly a whole raft of previously mysterious phenomena are revealed as sensible consequences of classical physics. We present some of the more recent, previously unpublished results of the QST model in a companion paper at ICCF-21.

In this paper we discuss the extent to which QST does—and does not—explain the many diverse experimental results observed in the pursuit of LENR. In a soon to be published paper, David Nagel challenges theoretical models of LENR to explain a set of experimental observations and consequent questions which any good theory of LENR should be able to answer [2]. The experimental results have all been observed and published on multiple occasions, and the questions posed are directed at uncovering the ability of any given theory of LENR to assist in producing more stable and reliable LENR experiments, hopefully leading eventually to commercial application and freedom from the burden of fossil fuels.

The cited paper provides a fortuitous framework for assessing the ability of QST to assist in the creation of a practical LENR solution. As QST places the LENR phenomenon on a classical physics foundation, it becomes clear there are only a few basic conditions that must be present for LENR to occur:

1. A physically *stable target nucleus* experiencing minimal phonon motion.

2. An *impact nucleus with sufficient speed* (i.e. energy) to overcome the opposing Coulomb forces.

3. A *trajectory*, possibly guided by the lattice, encouraging the impact nucleus to collide with the target.

Nearly all of the observed experimental phenomena can be understood in terms of aiding or impeding one or more of these conditions. Many of the experimental conditions might promote one of these at the expense of the another, nonetheless enhacing the overall conditions amenable to LENR.

This paper is not a defence of QST; instead, its current shortcomings are exposed. These may be due to inadequacies in the theory, but we see them more likely as the result of limited resources devoted thus far to resolving the remaining issues. This creates an important opportunity to make new contributions to both QST and LENR.

Even if some aspects of QST should prove useful in understanding LENR, this would not imply that other theories of LENR are somehow incorrect. Theories have a scope: a set of physical phenomena they explain and predict. Multiple theories can have overlapping scope. Furthermore, QST has the defect that its rather peculiar fundamental axioms must be embraced in order to confidently leverage its conclusions. These axioms are new and to some degree still unsubstantiated, relying on logic and circumstantial evidence to support the claims. In the face of these difficulties, other theories may be superior in explaining aspects of LENR until QST can mature to its full utility.

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[1] Blake, R., "The effect of particle creation on space", *J. Phys.: Conf. Ser.* **222,** No 1, 012043, 2010.
[2] Nagel, D., "Expectations of LENR Theories", JCMNS, to be published.