11 Predictions and Experimental Evidence

A theory, at best, is only as good as its predictive value.

In the following a number of predictions will be derived from the theory on CPs. Many, but not all, of the prediction are already backed by experimental evidence. Those predictions, which are not yet backed by experiments, could become proof points for verifying/falsifying the theory on CPs.

Also, the predictions offer themselves as a detailed guidance for technical implementations of LENR energy reactors.

11.1 Elements Working as LENR "Fuel"

CPs are bring atomic nuclei to unusually short distances in the order of 2 to 15 pm. In this environment tunneling of nuclei through the Coulomb barrier becomes probable.

It is predicted that the tunneling is not limited to specific elements. Therefore, all sorts of elements can react in LENR, not merely hydrogen and transition metals. This prediction is depending on the validity of the Coulomb tunneling hypothesis, see chapter 1.7.

This prediction is already backed by experimental evidence:

- The device built by Alexandra und Paulo N. Correa using pulsed anomalous glow discharge (PAGD) was releasing excess energy from just aluminum electrodes and maybe some air [20] [21].
- Gerald L. Wendt & Clarence E. Irion produced helium by decomposition of tungsten via high-current discharges. The experiment has been reproduced successfully by other researchers. No hydrogen was present in the experiments, but the emission of fast neutrons had been detected in this kind of experiments. The findings are indicating tungsten-tungsten fusion with subsequent fission [22] [23] [24].
- George Ohsawa observed the transmutation of carbon and oxygen into silicon and iron by arching between carbon electrodes in air [25].
- A. B. Karabut ignited glow discharges in low-pressure D_2, H_2, Kr and Xe gases with cathodes made of Al, Sc, Ti, Ni, Nb, Zr, Mo, Pd, Ta, W and Pt. He observed characteristic X-ray emissions, excess heat and gamma emissions with all gases and metals (the strongest emission was with deuterium and palladium). The results suggest that hydrogen is not strictly required for LENR [30].

11.2 LENR Reaction Products

Chapters 1.7, 1.8 and 1.9 provide examples of the many possible reaction routes in LENR.

It is predicted, that the byproducts of the LENR reaction can be virtually any element in the periodic table, not merely helium. This prediction is depending on the validity of the hypotheses in chapters 1.7, 1.8 and 1.9.

This prediction is already backed by experimental evidence: T. Matsumoto, Tadahiko Mizuno, George H. Miley, Yasuhiro Iwamura, and others [26] [27] [28] [29] discovered, that LENR devices are producing a wide range of elemental transmutations. Some of the created elements were lighter and some were heavier than the originating elements.

11.3 Fast Electron Emission, Lack of Ion Emission

The core of a CP always has a negative potential. Electrons, which are escaping out of the core (because their axial velocities have dropped below the critical limit), will be accelerated away from the core by the repulsive core potential.

It is therefore predicted that CPs are emitting electrons with kinetic energies with kinetic energies up to tens of keV.

In contrast, nuclei diffusing out of the CP will be attracted by the core potential. It is therefore predicted, that cations coming out of a CP will have practically no kinetic energy and will recombine with electrons in the vicinity of the CP.

There is experimental evidence in the writings of Ken Shoulders, that there is indeed electron emission from EVs (i.e. CPs). The most conclusive findings were stemming from his pinhole camera experiments [19]. Also, he found out that dielectric surfaces, which came in touch with CPs, were negatively charged afterwards as a result of the electron emission.

In contrast, Ken Shoulders couldn't detect any ion emission from the CPs, even under high amplification measurements.

Nonetheless, nuclei with several MeV of energy can be emitted from CPs as a result of nuclear reactions (spallation products). In most cases these are protons and alpha particles. Compared to the emission of electrons, the spallation radiation is very infrequent, though.

11.4 CP "Death Knell" Signature

CPs contain a repository of kinetic energy, which will be suddenly released, when the intrinsic current of the CPs stops and the nuclei and electrons recombine to ordinary atoms and molecules. This means that CPs will eventually bust, either by disruptions from external causes or by their normal decay.

It is predicted, that when a CP busts, a very specific signature of time-correlated radiation/signals can be measured. This signature includes:

- Sound: A sharp click occurs, when the CP transitions from its high matter density to the lower density of ordinary matter
- Radio frequency emission: A wide-band radio frequency "click" occurs, resulting from the sudden disappearance of the CP's magnetic moment
- Light and X-ray emission: When the electrons escape from their magnetic trap they will scatter and decelerate, leading to broad-band bremsstrahlung. The nuclei will then recombine with electrons, which is causing a line spectrum from X-ray through UV to light emission.

All types of emissions from this signature will occur synchronously in a very short time period.

There is not yet experimental evidence in the literature about this "death knell" signature of CPs. In practice, it should be possible to build a CP detector/counter, which time-correlates the signals of said signature.

11.5 Cathode Erosion, Anode Deposition

A CP emitted by a cathode requires electrons and nuclei to form. It is predicted, that not merely the electrons, but to a certain degree also the nuclei have to come out of the cathode. Therefore the cathode will erode at the point of CP emission, leading to craters in the surface.

It is further predicted, that the cathode nuclei can travel in the CP and can be deposited as a little droplet on the anode.

Additional corrosion at the cathode will occur, if closed-loop CPs are attaching themselves for some time to the surface of the cathode. This is further described in chapter 11.6.

There is experimental evidence for this phenomenon from several sources:

- Ken Shoulders has described the erosion of the cathode tip by EVs/CPs [2].
- It has been observed and documented by the Correas in [21]
- The presentation produced by Klimov A. et al. in 2017 [31] provides very clear photographic evidence for the cathode erosion, the anode deposits and the path of the CPs on their ways from the anode to the cathode through the plasma
- In 2007 W.-S. Zhang and J. Dash [32] published a document showing the craters on the surface of a palladium cathode after electrolysis in heavy water

11.6 Erosion of All Materials, No nuclear reactions in Crystal Lattice

It is predicted that all materials, which are coming in contact with CPs, will be eroded. The erosion is the result of ionization and re-condensation of the matter surrounding the CPs. Most of this ionization is based on the strong electric field between the core and the halo of CPs.

It is predicted, that no nuclear reactions can occur in the crystal lattice, because nuclear reactions would require the presence of CPs and CPs would destroy the lattice by ionization.

There is experimental evidence from many sources, that the tracks and craters on surfaces caused by CPs are erosive [1] [2] [6] [21] [31] [32].

No experimental evidence in known to the author, which would prove that nuclear reactions can occur in the lattice. The absence of evidence is significant, because the prevailing assumption of the Fleischmann paradigm is that the fusion occurs in the lattice.

11.7 Intrinsic Current, Magnetic Moment, Pseudo-Ferromagnetism

It is predicted that CPs always have an intrinsic axial current. The magnetic field of this current is strong enough to bend the CPs to a helical shape.

It is predicted that the helical shape in combination with the intrinsic current is in most cases leading to a strong magnetic dipole moment of CPs. The exception of this rule occurs, if CPs have a secondary structure like a toroid coil. In this case the magnetic field lines of the CPs are internally closed and no external magnetic moment can be measured.

It is further predicted, that the magnetic moments of CPs are aligning in an external magnetic field, such that the strength of the external magnetic field is increasing.

It is predicted that this "pseudo-ferromagnetism" will persist even at very high temperatures, way above the Curie temperature of all known ferromagnetic substances.

Some anecdotal evidence has been reported, that CPs are increasing an externally applied magnetic field. More systematic measurements have to be made to fully back these predictions.

11.8 Broad-Band Electromagnetic Radiation Stemming from Electrons

It is predicted that most of the electromagnetic radiation of CPs is stemming from the electrons, rather than from excited nuclei.

It is further predicted that CPs are causing broad-band emissions because of the density and delocalization of the electrons.

There are measurements available [30] [31] in support of this claim. The measured spectra are additionally showing some emission lines from ordinary atoms of the surrounding matter.

The very sharp gamma lines, which are typical of excited nuclei, are normally not found in LENR emission spectra. The exception of this rule is based on the death knell signature described in chapter 11.4.

11.9 Directed X-Ray Radiation in Parallel to Magnetic Field

The secondary structure of CPs is often quasi-periodic (helical). CPs in these cases can act like a free-electron laser.

It is predicted, that CPs can emit collimated laser-like pulses of x-ray and UV radiation.

It is further predicted that the laser pulses are directed in parallel to the magnetic field lines.

Laser-like x-ray pulses have been observed by Karabut [30].

Evidence is not yet available, that the collimated x-ray pulses will be directed in parallel to an externally applied magnetic field.

11.10 Triggering Energy, Non-Spontaneous Formation

It is predicted, that the formation of CPs is requiring triggering energy in form of a strong current pulse through a plasma. This means, CPs cannot form spontaneously, e.g. in hydrogen-loaded metals.

The many negative results in LENR history from attempts to replicate certain experiments can be attributed to a lack of such triggering energy.

11.11 Preference to Surfaces

It is predicted, that CPs can electrostatically attach themselves to surfaces.

There is a wealth of evidence from Shoulders, Savvatimova and others for this phenomenon [1] [2] [6] [7] [16].

11.12 Self-Sustained Growth, Nuclear Feedback

It is predicted, that CPs can grow their length and sustain their lifetime, if the right external conditions are met, such as:

- Nuclear fuel is available and can diffuse into the CPs
- Fast electrons are available in the surrounding matter
- Cations are available in the surrounding matter

It is predicted that the self-sustained growth of CPs is the result of a feed-back of nuclear energy to the electrons.

There is anecdotal evidence available from several sources, including Francesco Piantelli, Andrea Rossi, Sergey Tsvetkov and others, that LENR reactors can temporarily enter a self-sustained mode, where the heat production requires no input energy.

More experimental evidence needs to be produced in order to conclusively correlate the self-sustained episodes with the above conditions and to prove the nuclear feed-back mechanism.