

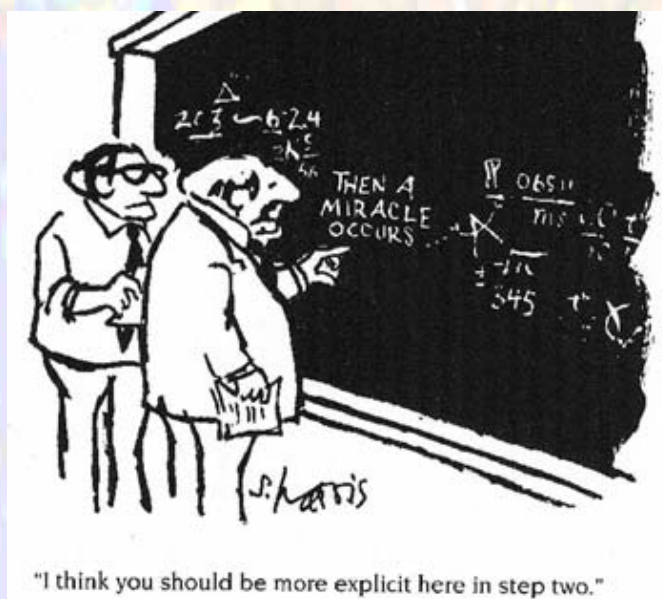
Seminar @ LRCS, Amiens, France (April 25, 2013)

Experiments vs. theory: the eternal debate?

by Dr. Habil. Alejandro A. Franco (LRCS)

Do experiments validate theory? Or does theory explain experiments? Can theory predict observables without prior calibration with experiments? Can experiments be interpreted without theory? To address a scientific question, what we should do at first? Developing a theory or carrying out experiments?

This seminar revisits this old but still hot debate by discussing real but also apparent controversies arising from linguistic differences between experimentalists and theorists, in particular in the field of applied electrochemistry. A current job day of a theorist is described, and the intellectual step by step process on creating "models", abstract entities aiming to mimic "real" systems, is explained. Practical aspects and methodological challenges on comparing theory outcomes with experimental data are discussed within a generalized viewpoint of the



Heisenberg's uncertainty principle and of the Gödel's incompleteness theorems. Finally, despite the existing difficulties, the seminar will show, through several examples of ongoing research for lithium air and lithium ion batteries and fuel cells, why and how the dividing lines between theory and experiment are inevitably and correctly becoming obsolete...

References

1. A.A. Franco, Multiscale modeling in electrochemical conversion and storage, in: Encyclopedia of Applied Electrochemistry, R. Savinell, K. Ota, G. Kreysa Eds. (Springer) (2013) to appear.
2. K. Gödel, On formally undecidable propositions of Principia Mathematica and related systems, *Monatshefte für Mathematik und Physik* **38** (1931) 173.
3. L. Landau, E. Lifshitz, Quantum Mechanics Non-Relativistic Theory, (Elsevier Science) (1958).
4. A.A. Franco, Degradation modeling and analysis, in: Fundamentals and Engineering of PEMFCs and DMFCs C. Hartnig, C. Roth, Eds. (Woodhead) (2012).
5. K. Malek, A.A. Franco, *J. Phys. Chem. B*, **115** (2011) 8088.
6. R. F. de Moraes, D. Loffreda, P. Sautet, A.A. Franco, *Electrochim. Acta*, **56** (2011) 10842.