

Stardust - Football - Solar Energy

A modern fairy tale of elemental Carbon



Dr. Konstantinos FOSTIROPOULOS

Helmholtz-Zentrum Berlin für Materialien and Energie, Berlin, Germany

Carbon is the fourth most abundant element in space and the first to grow solid nano-aggregates that agglomerate fluffily and form ... "stardust".

In 1985, cosmochemist Harry Kroto et al. discovered a cluster with 60 atoms in the mass spectrum of carbon vapors. The team daringly speculated that it could be the carrier of the famous 220 nm bump in the extinction curve of the Interstellar Medium and that it was a closed cage molecule in the shape of a ... "football".

Five years later, surprisingly, a Heidelberg team succeeded in the synthesis of C_{60} in large amounts and they confirmed the daring "football" speculation [1, 2]. Their paper triggered an amazing publication activity of over 1000 related papers per year (=World Championship), although it turned out that C_{60} was unfortunately not responsible for the 220 nm bump as hoped...

So what! Football fever broke out in the scientific community. Youngster as well as senior scientists young-at-heart suddenly transformed into passionate football fans leaving their work and following their basic play instincts. They declared the C_{60} Games open. They didn't even notice that the "footprint" of the amazing carbon cluster was discovered shortly afterwards by astronomers in the spectral range of the so-called Diffuse Interstellar Bands.

Also in 1985, Ching W. Tang and his team in the field of "solar energy" research fabricated ultra-thin absorber layers for cost-efficient organic solar cells (OSCs) applying organic semiconductor materials, with the absorber material being a nano-composite of donor and acceptor molecules. Later C_{60} was found to be an excellent candidate for the OSC's acceptor component due to its enormous electron affinity. Therefore, novel OSC concepts based on C_{60} acceptors with significant power conversion efficiencies of up to $\eta=2.5\%$ were introduced in the new millennium [3]. This triggered generous governmental and private funding in the range of a billion € worldwide for the "solar discipline" of the C_{60} Games. So that 2018 the efficiency record has increased seven-fold culminating in $\eta=17.3\%$.

Dr. Konstantinos Fostiropoulos is a Greek physicist with more than 80 publications and 10,000 citations, Senior Scientist at the Helmholtz-Zentrum Berlin für Materialien and Energie. He studied Physics at Heidelberg University, where he also received his doctorate in February 1992. Fostiropoulos completed his thesis on "C60 - a new Form of Carbon" at the Max Planck Institute for Nuclear Physics in Heidelberg, where he developed methods for the preparation and isolation of C_{60} in quantitative amounts. His preparation method applying an electric arc process under vacuum conditions is used today as an industrial production process.



ΣΕΜΙΝΑΡΙΟ

Τμήματος Φυσικής

Τετάρτη

12 Φεβρ. 2020

13:15

ΣΘΕ, 1^{ος} όροφος

Αίθουσα Α31



Αριστοτέλειο Πανεπιστήμιο
Θεσσαλονίκης
ΤΜΗΜΑ ΦΥΣΙΚΗΣ



ΑΡΙΣΤΟΤΕΛΕΙΟ
ΠΑΝΕΠΙΣΤΗΜΙΟ
ΘΕΣΣΑΛΟΝΙΚΗΣ