

## ECOSF and UISMS jointly hosted a Lecture on Popularising Mathematics and Science by Prof. Yousef Sobouti

**July 25, 2023** - As part of the Lecture Series on Popularizing Mathematics and Science, jointly hosted by the ECO Science Foundation (ECOSF) and the Union of Iranian Societies of Mathematical Sciences (UISMS), Prof. Yousef Sobouti delivered a captivating and inspiring talk. Prof. Yousef Sobouti is a renowned Iranian Physicist affiliated with Institute for Advanced Studies in Basic Sciences – Zanjan, Iran.

**Lagrangian density for Dirac + EM fields**

$$L = \bar{\psi}[\gamma_{\mu}(\partial_{\mu} - ie z A_{\mu}) + i e z (\kappa \alpha_0) \gamma_{\mu} \gamma_{\nu} \partial_{\nu} A_{\mu} + m] \psi + \frac{1}{4} z F_{\mu\nu} F^{\mu\nu}$$

where  $z$  and  $\kappa$  are two coupling constants to be decided later.

- Euler-Lagrange eqns are:

$$[\gamma_{\mu}(\partial_{\mu} - ie z A_{\mu}) + i e z (\kappa \alpha_0) \gamma_{\mu} \gamma_{\nu} \partial_{\nu} A_{\mu} + m] \psi = 0$$

$$\partial^{\alpha} \partial_{\alpha} A_{\mu} = J_{\mu} = -ie \bar{\psi} \gamma_{\mu} \psi + \frac{1}{4} i \kappa \alpha^2 \alpha_0 \partial_{\nu} (\bar{\psi} \gamma_{\mu} \gamma_{\nu} \psi)$$

- These eqns are invariant under the gauge

$$\psi' = \exp(i e \chi / c) \psi, \quad A'_{\mu} = A_{\mu} + \partial_{\mu} \chi, \quad \partial^{\mu} \partial_{\mu} \chi = 0$$



Over 60 enthusiastic participants from the ECO region joined the event online, and more than 40 participants gathered physically at Shaheed Benazir Bhutto University Sheringal Dir Upper, where they participated with the lecture in person.

3) Left out restricted Lorentz gauge from U(1)

- Conventional U(1) symmetry leaves quantum dynamics invariant under a 'general' Lorentz gauge and imposes the standard minimal coupling of QW to the EM 4-vector potential,  $A_{\mu}$ .
- One, however, has the option to ask for invariance under the 'restricted' Lorentz gauge. This invites in a coupling to the derivatives of the vector potential,  $\partial_{\nu} A_{\mu}$ , beyond the minimal coupling. This enlarges U(1).



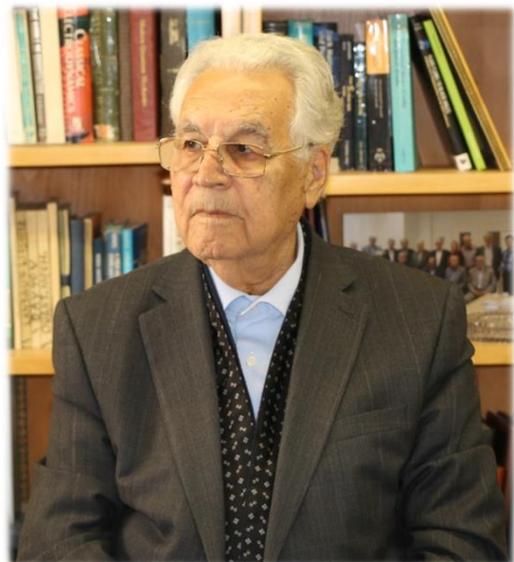
The lecture was divided into two parts, with the first part focusing on "Understanding Others the Science Way." Prof. Sobouti emphasized the crucial distinction between evidence-based sciences and opinion-based doctrines. He highlighted that evidence-based sciences derive their credibility from observations, conclusions, and predictions that are consistent with each other. On the other hand, opinion-based doctrines rely on the reputation and social influence of their authors and followers. Prof Sobouti highlighted that human body of knowledge on the steps of a ladder, beginning from the most exact and best "evidence-based" sciences and ending with the least verifiable "opinion- based" creeds.

In the second part of the lecture, Prof. Sobouti presented three arguable concepts: the notion of point particle singularity, the asymmetric action of electromagnetic fields on quantum wave functions, and the significance of the left-out restricted Lorentz gauge from  $U(1)$ .

The lecture concluded with an interactive Q&A session, allowing participants to engage directly with Prof. Sobouti and explore further insights. In his closing remarks, Prof. Seyed Komail Tayebi, President of ECOSF stressed the importance of popularizing mathematics and science. He expressed deep gratitude to Prof. Sobouti, and special thanks to Prof. Ali Rejali, and all the participants for their active participation. The lecture series will continue to spark curiosity and foster a deeper understanding of the captivating world of Mathematics and Science.

### **About Prof. Yousef Sobouti.**

Prof. Yousef Sobouti studied physics in the University of Tehran. He went to the University of Toronto for an M.Sc. degree, and later in 1960 to the University of Chicago for a Ph.D. degree in astronomy and astrophysics under the supervision of renowned physicists, including Subramanian Chandrasekar and Joseph Chamberlain. In 1963, He took up a lecturer position in Newcastle University in England.



Prof. Sobouti began his academic journey as an associate professor at Shiraz University. During his tenure, he played a pivotal role in shaping the modern university system in Shiraz. His significant contributions led to the establishment of M.Sc. and Ph.D. programs at the university, and he laid the foundations for the renowned Biruni Observatory in 1972, which remains the country's only functional center of its kind.

In 1991, Prof. Sobouti founded the Institute for Advanced Studies in Basic Sciences in Zanjan (IASBS). Today, the IASBS stands as one of Iran's premier institutions for higher education and academic research, boasting an impressive roster of over 1000 graduates at the M.Sc. and Ph.D. levels.

Prof. Sobouti's published over 100 research articles published in peer-reviewed international journals, and he has supervised more than 50 graduate scholars.