The Khursheed A. Siddiqui Memorial Lecture to be delivered during *the Fourth International Conference on Physics and the World of Today in the Memory of Prof. Dr. Khursheed A. Siddiqui, Prof. Dr. Riaz A. Hashmi and Prof. Dr. Feroz Ahmed*, Department of Physics, University of Karachi, Pakistan, January 2, 3, 2025 (Tuesday, January 2, 2025, Physics Auditorium, University of Karachi), Inaugural Session, p 1

From the Galilean Transformations to the Scaled-Poincaré Transformations: A Journey of 337 Years (1632-2009)

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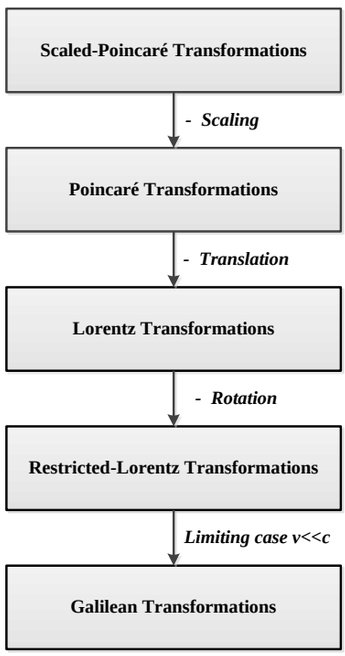

Fig. 1. Timeline of evolution from the Galilean transformations (1632) to the scaled-Poincaré transformations (2009)

In this lecture the historical foundations of relativity shall be explored elaborating that the key concepts and the key mathematical expressions existed well before **Albert Einstein**. One year before the publication of Einstein's paper, **Henri Poincaré** (1904) enunciated the principle of relativity. Also, complete mathematical framework was available through works of **Woldemar Voigt** (1887), **Joseph Larmor** (1897) and **Hendrik Antoon Lorentz** (1892, 1895, 1899, 1904). Long before that (**Abū ʿAlī al-Ḥusayn bin ʿAbdullāh ibn al-Ḥasan bin ʿAlī bin Sīnā al-Balkhi al-Bukhari) Ibn-é-Sina** discussed space and time in his *Risala-é-Tabiyaat* (Journal of Physics). (**Mohummed ibn Mohummed ibn al-Hasan al-Tūsī) Kawaja Naseeruddin Tūsī** (1238 Iranian Year) says that time ascribes everything and, therefore, something is first and something is last relative to time. Time ordering of events (causality) occupies an important place in modern relativity theory. Tūsī, further, observes that the entire universe is ascribed by space and in this connection, something is exposed and something is hidden relative to space. In addition, he comments that space and time are not complete in themselves. In theory of relativity space and time are not considered as separate things, but time is considered as a coördinate like space coördinates. Hence, special theory of relativity is constructed employing *spacetime-vector-field formulation 4 dimensions* (avoid using the terminology '4-vector', which is dual to '4-form'). **Ṣadr ad-Dīn Mohummed Shīrāzī**, in *Hikmat Al Muta'alyahfi-l-asfar al-ʿaqliyya al-arbaʿa* (Urdu translation**:** *Asfar-é-Arbăa* — Four Journeys), says about the doubt of **Fakruddin Raazi** (*Ouoon-ul-Hikmat* — Springs of Knowledge) that **Əbülhəsən Bəhmənyar Azərbaycani** mentioned this doubt and then, himself, refuted it. Behmenyar thinks that if the existence of motion is disproved, then it is that motion, which is called 'absolute motion'. He thinks that absolute motion is not, externally, present. But Shīrāzī thinks that 'relative motion' is not, externally, present. He argues that absolute motion has not any such form in the external as that of things, which are stationary. One may realize that even Lorentz subscribed to the notion of absolute rest and absolute motion, whereas Shīrāzī and others put forward and elaborated the concept of relative motion. In his paper, *Zur Electrodynamik bewegter Korper* (on the Electrodynamics of Moving Bodies), published in 1905, Albert Einstein combined these existing conceptual and mathematical formulations into an integrated and a unified approach, without giving reference to these contributions, followed by **Herman Minkowski**'s setting up of *special theory of relativity* in 4-dimensional covariant formulation. As early as 1911, it was shown that the assumption of existence of an invariant velocity was not necessary for the derivation of Lorentz transformations. The postulates of relativity, therefore, take the form**:** *First Postulate* — spacetime is homogeneous and space is isotropic; *Second Postulate* — physical laws of mechanics and electromagnetism are required to be covariant, when passing from one inertial frame to another frame in rectilinear, uniform relative motion (principle of relativity). **Henri Poincaré** established, quite generally, the invariance of Maxwell's equations, obtaining the Poincaré transformations, which were the most general coördinate transformations during 1905-2008, when the scaled-Poincaré transformations took their place, introduced by the speaker in 2009 to avoid infinities appearing in the Poincaré transformations. The Poincaré transformations become undefined at $v = c$ (Fig. 1). This paper is dedicated to the loving memory of **Prof. Dr. Khursheed A. (Athar) Siddiqui** (Friday, January 2, 1948 AC**:** Safar-ul-Muzaffar 20, 1367 AH, Hyderabad Deccan — Friday, October 7, 2022 AC**:** Rabi-ul-Awwal 10, 1444 AH, Karachi, Pakistan). Siddiqui received all of his education up to MSc from Karachi — SSC in 1964, HSC in 1966, BSc in 1968 (DJ Science College), MSc, Physics, in 1971 (University of Karachi) and PhD in 1978 (University of Nottingham, England). He joined Department of Physics, University of Karachi as lecturer in 1979 and took early retirement in September 2004. He, also, served Departments of Physics in University of Baluchistan, Quetta, Pakistan and King Abdul Aziz University, Jeddah, Saudi Arabia as well as Visiting Faculty in Department of Chemistry, University of North Carolina, Chapel Hill on a Fulbright fellowship. His MPhil student, Prof. Dr. Mohummed Shahid Qureshi served as Director of ISPA (Institute of Space and Planetary Astrophysics), University of Karachi. His PhD student, Prof. Dr. Nasiruddin Khan worked as Pro-Vice Chancellor of University of Karachi. Other students, who reached top positions, are Prof. Dr. Jameel-un-Nabi, DSc (United States), Vice Chancellor, University of Wah, Rawalpindi, and Prof. Dr. Shabana Rizvi, Chairwoman, Department of Physics, University of Karachi. He organized many conferences and seminars and edited their proceedings. The speaker had a very special bonding with his dear friend. Upon returning from the United States, the speaker was offered to share office by his colleague. Prof. Siddiqui was instrumental in helping the speaker select his PhD topic and provided literature to start the work. In addition, the speaker and his colleague traveled together to many scientific conferences. The legendary professor had 10 journal papers and 8 conference presentations in common with the speaker in neurophysics, modeling of the heart function, mathematical and theoretical physics as well as physics teaching and curriculum development. It is to be noted that, probably, the first proposal to replace BSc, BSc (Honors) and MSc with BS and MS in the Pakistani curriculum was given in 1989, which was adopted by Higher Education Commission, Government of Pakistan in 2004. University of Karachi honored Prof. Siddiqui by making him a member of ASRB after his retirement. He leaves behind his wife, a son, a daughter and 5 grandchildren. Detailed biography is given in a paper by speaker dedicated to the memory of his dear colleague. Ahmed Shahzad Khan of Chicago, United States wrote an obituary of Prof. Siddiqui. On October 13, 2022, Department of Physics organized a condolence meeting to remember their beloved colleague (Fig. 2).

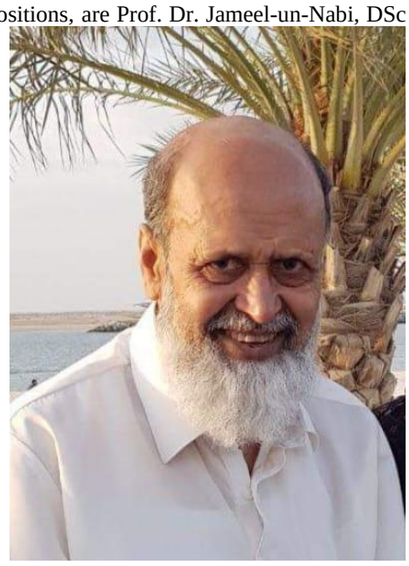

Fig. 2. Khursheed A. Siddiqui

*Keywords***:** Albert Einstein • Ibn-é-Sina • Lorentz transformations • Postulates of relativity • Ṣadr ad-Dīn Mohummed Shīrāzī