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Alexander Turbiner, Professor, Institute of Nuclear Science
Universidad Nacional Autónoma de México

Title: Choreography in Nature (towards theory of dancing curves, superintegrability)

Abstract:
By definition the choreography (dancing curve) is a closed trajectory on which n classical bodies move chasing each other without collisions. The first choreography (the Remarkable Figure Eight) at zero angular momentum was discovered in physics unexpectedly by C Moore (Santa Fe Institute) at 1993 for 3 equal masses in R3 Newtonian gravity numerically and independently in mathematics by Chenciner-Montgomery at 2000. At the moment about 6,000 choreographies in R3 Newtonian gravity are found, all numerically for different n > 2.
Does exist (non)-Newtonian gravity for which dancing curve is known analytically? - Yes, a single example is known - it is algebraic lemniscate by Jacob Bernoulli (1694) - and it will be a concrete example of the talk. Astonishingly, R3 Newtonian Figure Eight trajectory coincides with algebraic lemniscate with $\chi 2$ deviation $\sim$ 1E-7 . Both choreographies admit any odd numbers of bodies on them. Both 3-body choreographies define maximally superintegrable trajectory with 7 constants of motion.
Talk will be accompanied by numerous animations.