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The exact expression for increasing selectivity through statistical fluctuations in a system with a threshold

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In various statistically defined situations, like referendum, epidemic threshold, mass service process or a chemical sensor the probability of overall output coincides with the probability that a threshold N_0 number of elementary events has been achieved. The latter depends on the probability p that a single elementary event happens. Elementary event for a referendum case is the positive vote of a single voter; for a chemical sensor − is the ligand binding by a single receptor in the sensor. The probability p of elementary event may depend on some external factor − campaigning type L for the referendum case, or the ligand type L applied in the case of chemical sensor. This constitutes the selectivity of elementary event. Naturally, the probability that the threshold N_0 is achieved depends on L as well. This constitutes the selectivity of essential event. Any of the two selectivities can be expressed by means of a dimensionless non-negative number. We derive a concise mathematical expression, for comparing the two selectivities, based on the incomplete beta-function, or on a continued fraction. Possible application in a chemical sensor is discussed.

Primary author: VIDYBIDA, Oleksandr (Bogolyubov Institute for Theoretical Physics)

Presenter: VIDYBIDA, Oleksandr (Bogolyubov Institute for Theoretical Physics)

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