RECURRENCE OF RANDOM PSEUDO-EUCLIDEAN WALKS

Koganov A.V.

Russia, Moscow, 117218, Nakhimovsky st., 36, corpus 1, Federal Science Center System Research Institute of Russian Academy of Sciences (FGU FNC NIISI RAN) (SRISA)
akoganov@yandex.ru

We consider discrete random walks $x(t)$ ($t = 1, ...$), radius vector $r(t) = |x(t)|$, in continuous linear spaces. We study the return property of a symmetric walk (when with probability 1 the walk returns to any neighborhood of the past point). Theorem 1. If at some point the walk has a centrally symmetric probability density of displacement, and the effective dimension n is at least two, then $E\{r(t+1) - r(t)\} > 0$ at displacement from this point, and $P\{r(t+1) > r(t)\} > P\{r(t+1) < r(t)\}$. If $n = 1$, then $E\{r\} = 0$. Theorem 2. Isotropic homogeneous walks are returnable for $n = 1$ and 2, and non-returnable for $n > 3$. Theorem 3. The direct product of the walks return, and then only when the return on both components. Theorem 4. In the case of a topological transformation of the walk space, the property of return or non-return is preserved. For a pseudo-Euclidean space, we select The T-projection of the displacement on the time axis and the S-projection on the space-like hyperplane. Theorem 5. Let the walk be T-symmetric and S-isotropic, with both T and S projections having finite mathematical expectations, finite dispersion, and non-zero densities in any neighborhood of zero. Then the walk is returnable for the S-hyperplane dimension 1 or 2, and non-returnable for other dimensions; in the case of returnable (and only in this case), the walk points everywhere densely fill the entire space. Contravariance of the jump to the automorphism of the space U is defined as: $P(x \in V|Uy) = P(x \in UV|y)$. Theorem 6. If an automorphism generates a bijection on a Sigma algebra, then it generates a contravariant transformation of the probability distribution. Then, if (and only if) the Jacobian at each point is 1, then the probability density is transformed contravariantly. These results are interpreted in mathematical physics. The 3+1 dimension is found to be minimal when random walks that are contravariant to the Lorentz group and satisfy theorem 5 become non-returnable. (Examples are constructed.) The return of the walk actually means a collapse in the model, where the walk points mean the birth of energy-carrying physical events. The contravariance of the model means the relativity principle for the event generation process.

References.

1. Koganov A.V. Model of physical space-time as a trajectory of a random process in external parametric time. // Metaphysics 2020, no. 2 (36), pp. 50-61 (ISSN 2224-7580)