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Small Spins of Primordial Black Holes from Random Geometries

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Black hole entropy is a robust prediction of quantum gravity with no established phenomenological consequences to date. We use the Bekenstein-Hawking entropy formula and general-relativistic statistical mechanics to determine the probability distribution of random geometries uniformly sampled in phase space. We show that this statistics (in the limit $\hbar \rightarrow 0$) is relevant to large curvature perturbations, resulting in a population of primordial black holes with zero natal spin. In principle, the identification of such a population at LIGO, Virgo, and future gravitational wave observatories could provide the first observational evidence for the statistical nature of black hole entropy.