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An enumerative formula for the spherical cap discrepancy

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The spherical cap discrepancy is a widely used measure for how uniformly a sample of points on the sphere is distributed. It is particularly important for estimating the integration error for certain classes of functions on the sphere. Being hard to compute, this discrepancy measure is typically replaced by some lower or upper estimates when designing optimal sampling schemes for the uniform distribution on the sphere. A fully explicit, easy to implement enumerative formula for the spherical cap discrepancy is provided. This formula is of combinatorial nature and, thus, its application is limited to spheres of small dimension and moderate sample sizes. It could be shown that the cap discrepancy is Lipschitz continuous in a neighbourhood of so-called generic point sets. This property may have some impact on optimal quantization, i.e., on finding point sets of fixed size on the sphere having minimum spherical discrepancy.

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