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Topological defects induced by the retina's curvature improve vision JOHNATAN ALJADEFF, TATYANA SHARPEE, Computational Neurobiology Laboratory, The Salk Institute; Center for Theoretical Biological Physics and Department of Physics, UCSD — The theory of disclinations and dislocations on curved surfaces predicts the length and density of grain boundary scars on a sphere. These predictions were successfully tested with colloids on droplets for systems satisfying $5 \leq R/a \leq 20$ (R- sphere radius, a- lattice constant). The foveal cone mosaic is another realization of this problem, for which $R/a \sim 10^4$. New theories are needed to extend current predictions for scar length and density to this regime. We present a method of introducing the effect of irregularities that changes the prediction in the relevant regime. We do so by deriving a noise induced disclination density which truncates the scars: the cone density is mapped to an effective displacement h_{eff} from the sphere; then the deviation from the constant curvature is computed to first order in h_{eff}; and finally the effective curvature is compared to a threshold above which noise induced disclinations appear. We compare stimuli projected on mosaics and on jittered lattices and show that the curvature induced correlations in the mosaics reduce aliasing by a factor of up to 50. This reduction increases with spatial frequencies, meaning that anti-aliasing is maximal in the visual acuity limit.

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