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Ramification of stream networks HANSJOERG SEYBOLD, OLIVIER DEVAUCHELLE, ALEXANDER PETROFF, ROBERT YI, DANIEL ROTHMAN, MIT — The geometric complexity of channel networks arises from their successive ramifications — the splitting of a single tip into two branches. Here we show that streams incised by groundwater seepage split at a characteristic angle of $\alpha = 2\pi/5 = 72^\circ$. Our theory represents streams as a collection of paths growing and bifurcating in a diffusing field, which can be described by Loewner dynamics. Analysis of thousands of bifurcations in a $\sim$100 km^2 stream network reveals that the mean branching angle is $72.5^\circ \pm 1.5^\circ$ (95% C.I.) and that the five fold symmetry induced by the branching of the tips is observed on all scales in the network. This consistency between theory and observation suggests that the network geometry is determined by the external flow field rather than flow within the streams themselves, contrary to assumptions made by models that relate geometry to internal dissipation.

Hansjoerg Seybold
MIT

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