The asymptotic distribution of the length of Beta-coalescent trees

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We derive the asymptotic distribution of the total length L_n of a $\operatorname {Beta}(2-\alpha,\alpha)$-coalescent tree for $1<\alpha<2$, starting from n individuals. There are two regimes: If $\alpha\le1/2(1+\sqrt{5})$, then L_n suitably rescaled has a stable limit distribution of index α. Otherwise L_n just has to be shifted by a constant (depending on n) to get convergence to a nondegenerate limit distribution. As a consequence, we obtain the limit distribution of the number S_n of segregation sites. These are points (mutations), which are placed on the tree's branches according to a Poisson point process with constant rate.

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