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Network growth dynamics of fire ant (*Solenopsis invicta*) nests NICK GRAVISH, School of Physics, Georgia Tech, MICHAEL A.D. GOODISMAN, School of Biology, Georgia Tech, DANIEL I. GOLDMAN, School of Physics, Georgia Tech — We study the construction dynamics and topology of fire ant (*Solenopsis invicta*) nests. Fire ants in colonies of hundreds to hundreds of thousands create subterranean tunnel networks through the excavation of soil. We observed the construction of nests in a laboratory experiment. Workers were isolated from focal colony and placed in a quasi 2D, vertically oriented arena with wetted soil. We monitored nest growth using time-lapse photography. We found that nests grew linearly in time through tunnel lengthening and branching. Tunnel path length followed an extended power law distribution, $P\ (l-l_0)^{\beta}$. Average degree of tunnel nodes was $k = 2.17 \pm 0.40$ and networks were cyclical. In simulation we model the nest growth as a branching and annihilating levy-flight process. We study this as a function of dimensionality (2D and 3D space considered) and step length distribution function $P(l_s)$. We find that in two-dimensions path length distribution is exponential, independent of the functional form of $P(l_s)$ consistent with a poisson spatial process while in three-dimensions $P(l) = P(l_s)$. Comparing simulation and experiment we attribute the slower than exponential tail of $P(l)$ in experiment as a result of a behavioral component to the ant digging program.

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