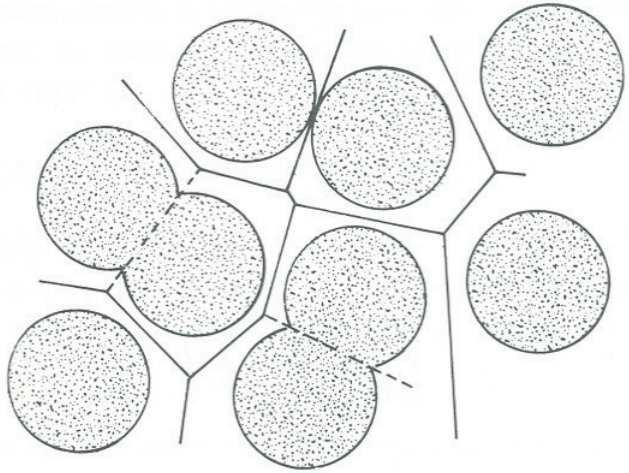
Non-universal behavior in the continuum:

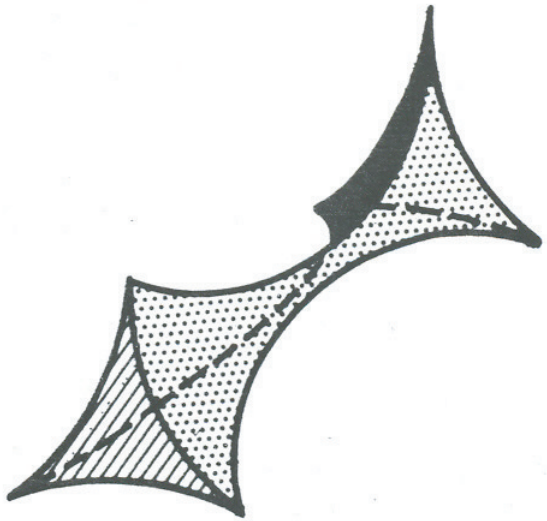
critical exponents for transport in Swiss cheese model take values different than for lattices, e.g. $t > 2$

$e \neq t$

Halperin, Feng, Sen, *Phys. Rev. Lett.* 1985



Swiss cheese model
$d = 2$



conducting neck in $d = 3$
Swiss cheese model

in general, non-universal exponents arise from a singular distribution of local conductances

In sea ice, this distribution is lognormal.

(excluding inclusions below cutoff)

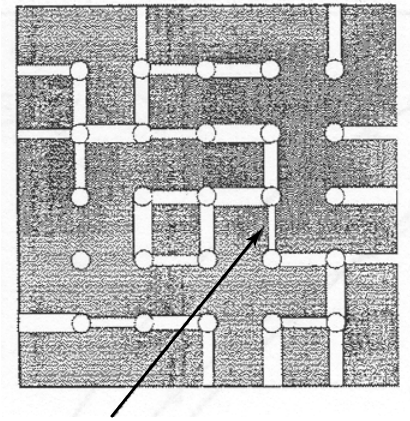
Thus, the permeability exponent for sea ice is **2**, the universal lattice value.

ESTIMATE fluid conductivity scaling factor $k_0 = r^2 / 8$

for media with broad range of conductances

CRITICAL PATH ANALYSIS

bottlenecks control flow



critical pore

Ambegaokar, Halperin, Langer 1971: CPA in electronic hopping conduction
Friedman, Seaton 1998: CPA in fluid and electrical networks
Golden, Kozlov 1999: rigorous CPA on long-range checkerboard model

$k_0 \approx r_c^2 / 8$ critical fluid conductivity

Microstructural analyses yield $r_c \approx$ 0.5 mm