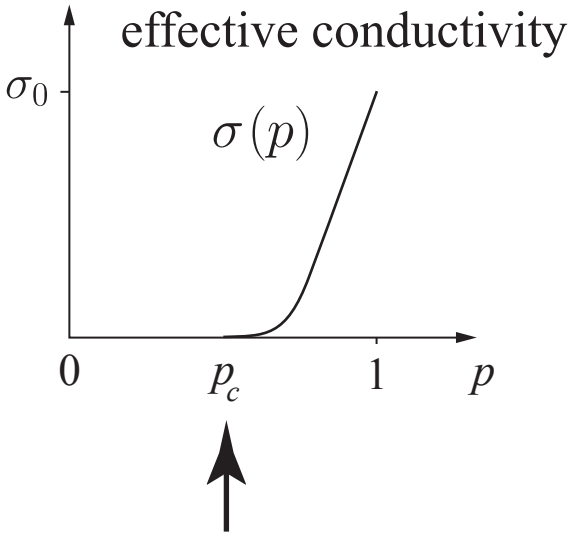

Critical behavior of transport near percolation threshold

conductivity

$$\sigma(p) \sim \sigma_0 (p - p_c)^t, \quad p \to p_c^+$$

permeability

$$\kappa(p) \sim \kappa_0 (p - p_c)^e, \quad p \to p_c^+$$

conductivity exponent t

UNIVERSAL for lattices

depends only on dimension, $e = t$

$d = 3$ **numerical** $t \approx 2$ **rigorous bound** $1 \leq t \leq 2$

Golden PRL 1990

in continuum - exponents can be ***non-universal***

SWISS CHEESE ***Halperin, Feng, Sen PRL 1985***

lattice and continuum percolation theories yield:

$$k(\phi) = k_0 (\phi - \phi_c)^2$$

critical exponent t

$$k_0 = 3 \times 10^{-8} \text{ m}^2$$

- exponent is UNIVERSAL lattice value $t \approx 2.0$ from general structure of brine inclusion distribution function (-- other saline ice?)
- sedimentary rocks like sandstones also exhibit universality
- critical path analysis -- developed for electronic hopping conduction -- yields scaling factor k_0
- no free parameters - microstructural input only