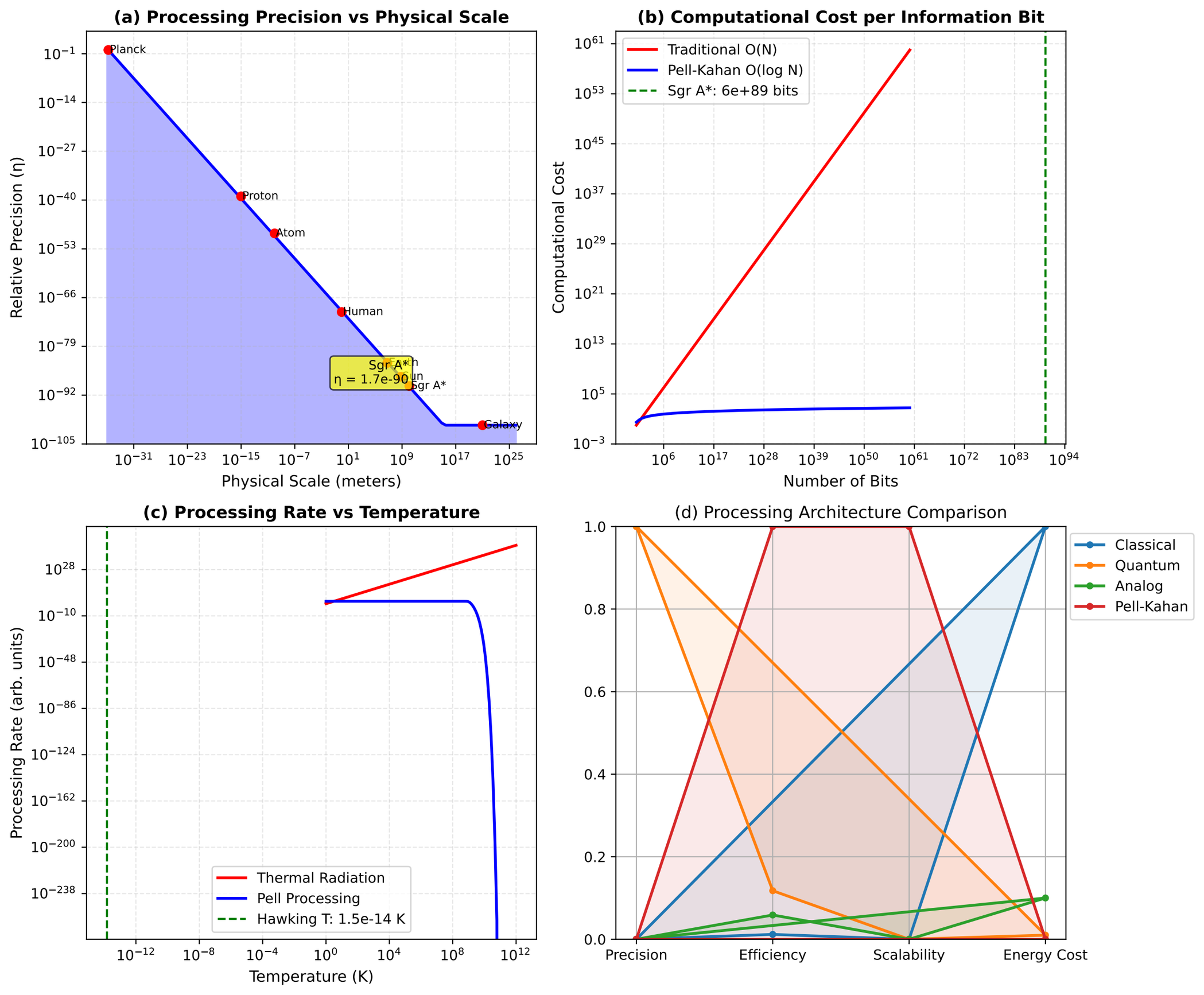
(a) Processing Precision vs Physical Scale
Relative Precision (η)
Physical Scale (meters)
Planck
Proton
Atom
Human
Sgr A*
Galaxy
Sgr A*
η = 1.7e-90
(b) Computational Cost per Information Bit
Computational Cost
Number of Bits
Traditional O(N)
Pell-Kahan O(log N)
Sgr A*: 6e+89 bits
(c) Processing Rate vs Temperature
Processing Rate (arb. units)
Temperature (K)
Thermal Radiation
Pell Processing
Hawking T: 1.5e-14 K
(d) Processing Architecture Comparison
Classical
Quantum
Analog
Pell-Kahan
Precision
Efficiency
Scalability
Energy Cost