Research by D.T. Son

- Heavy ion collisions: the kinetics of thermalization (with Al Mueller)

  Heavy ion collisions at very high energies can be described by perturbative QCD. We have constructed a theory describing the kinetics of such processes. Our analysis shows that the system reaches thermal equilibrium with a maximal temperature of order $\alpha^{2/5}Q_s$, where α is the strong coupling and Q_s is the saturation scale (1 GeV at RHIC, 2-3 GeV at LHC). This is the first theoretical demonstration of thermalization from pure perturbative QCD. We plan to do a more quantititive analysis of heavy ion collisions in the future.

- Matter at high density

  Understanding the behavior of matter at very high densities is important for the physics of neutron stars and heavy ion collisions. The problem is hard: for example, no lattice technique is known to work. However, at very high densities where matter is in the state of “color superconductivity”, many interesting properties can be reliably calculated from first principle.

  This field is attractive since it lies on the border between particle physics and condensed matter physics.