# Theory Behind Heavy Ion Collisions

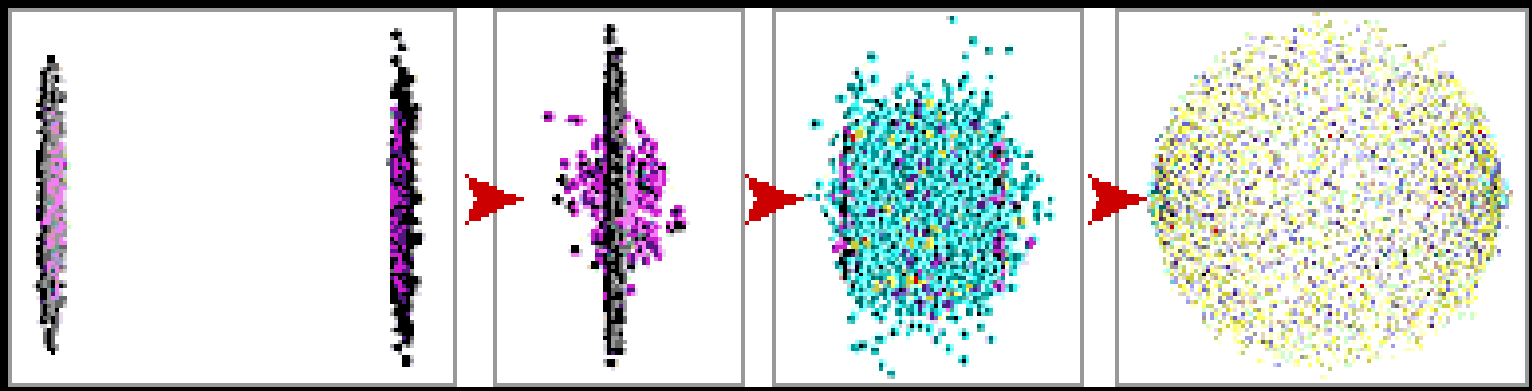
By: Jennifer Fan

# About RHIC

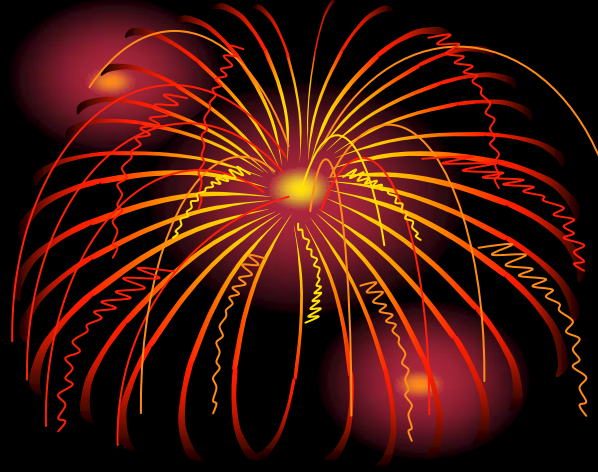
- RHIC (Relativistic Heavy Ion Collider) at Brookhaven Laboratory

- used to study conditions of early universe

- heavy ions smashed together at near the speed of light



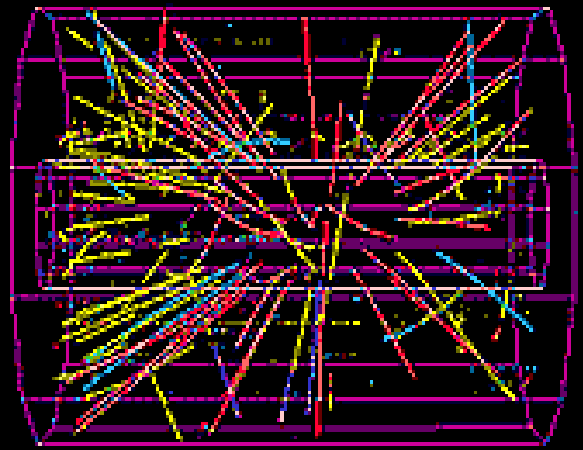
# RHIC Physics



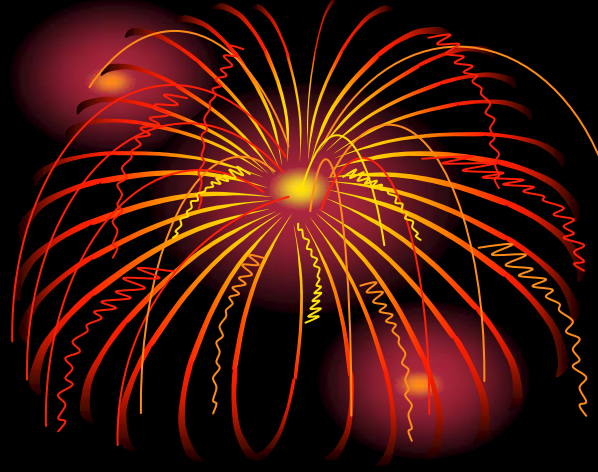
- collision “melts” protons and neutrons → free quarks and gluons

- thousands of particles form as area cools → clues to what happened at collision zone

- RHIC allows us to “go back in time”

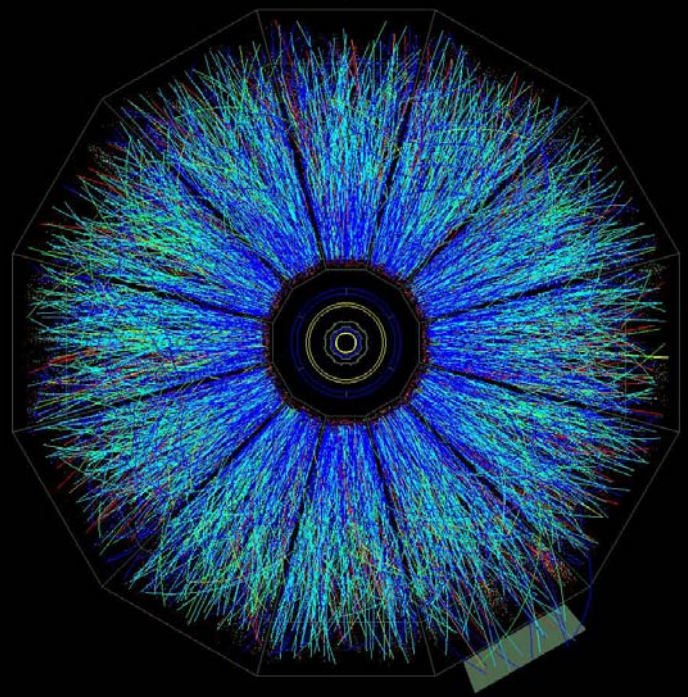


# QGP



- QGP (quark gluon plasma)

- RHIC collisions compress heavy ion nuclei → protons and neutrons overlap → extremely energetic area of quarks and gluons (QGP)



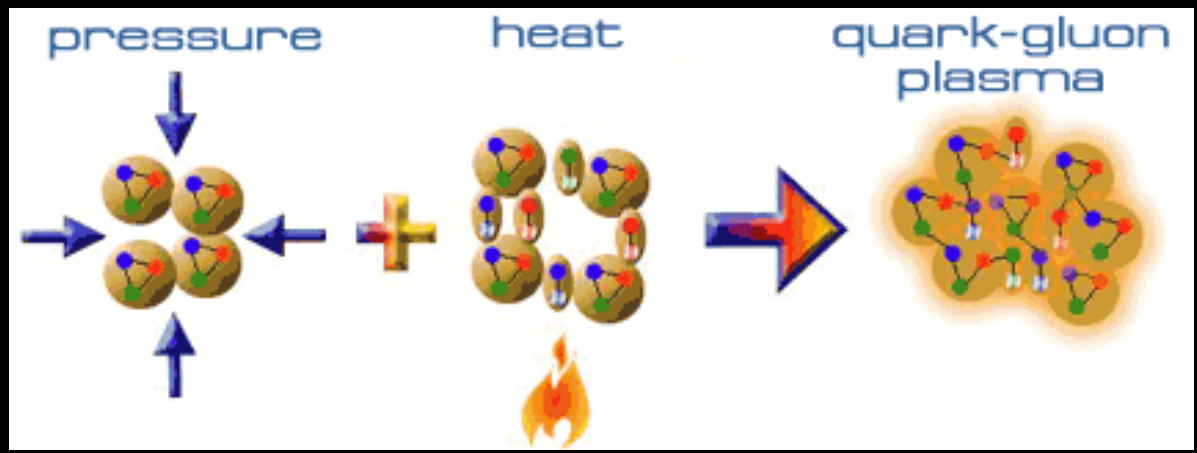
# QGP (cont'd)

- trios of quarks and gluons bound in nucleons

- pions (quarks + anti-quarks) appear as pressure and temperature rise

- phase change occurs under extreme conditions

- (in plasma) quarks, anti-quarks, and gluons free from usual bounds

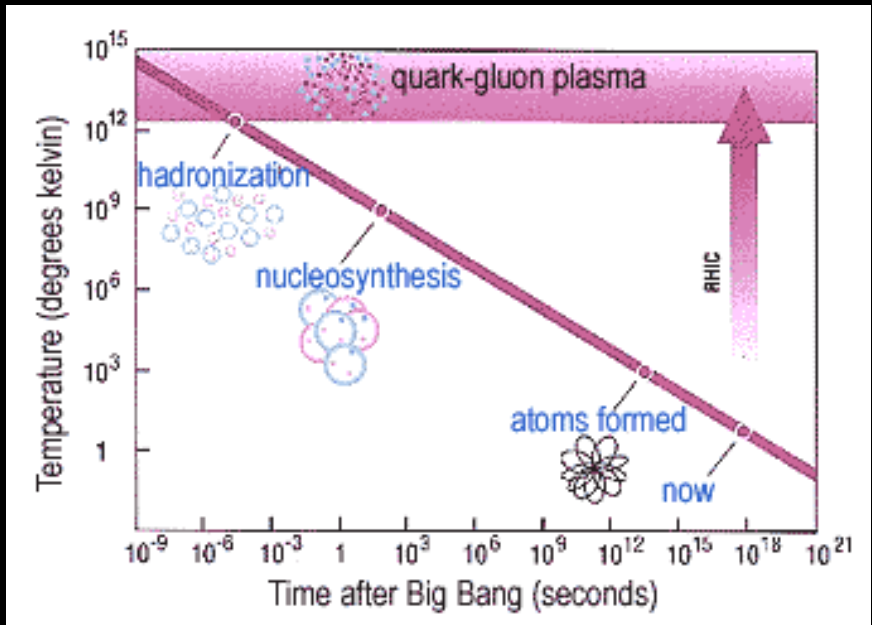


# QGP (cont'd)

- QGP formed quickly cools and coalesces into hadrons

- able to tell if QGP formed by looking at resulting particles

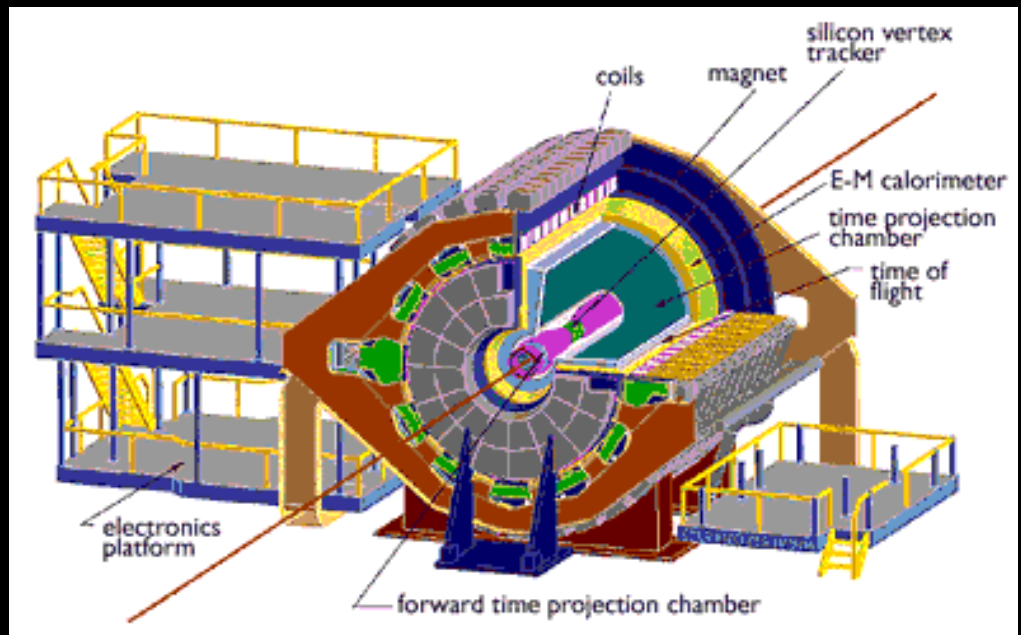
- collision that forms QGP will send out different kinds and ratios of particles than other collisions



# STAR

- STAR (Solenoidal Tracker at RHIC)

- purposes: a) detects resulting particles from ion collisions
  b) search for QGP signature
  c) investigate behavior of high energy densities with measurements

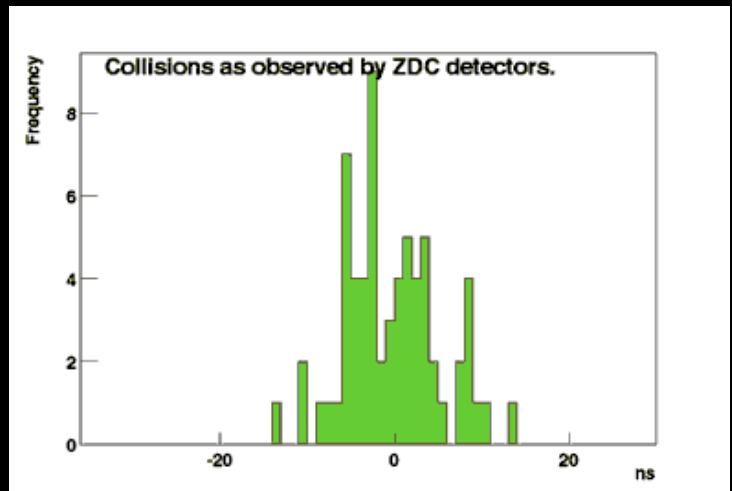


# STAR (cont'd)

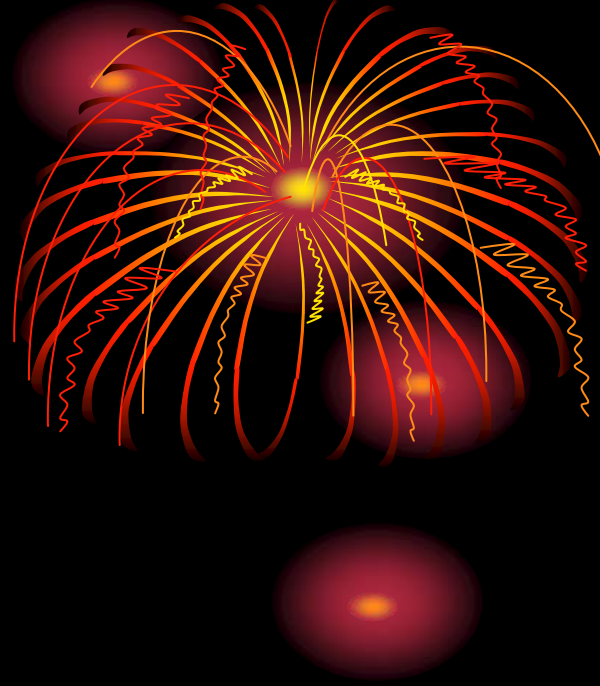
- Time Projection Chamber at heart of STAR
  - tracks and identifies resulting particles of collisions

- STAR uses powerful computers to reconstruct sub-atomic interactions that resulted in the production of particles

- histograms and other graphs used to analyze data



# Last Thanks



Note: all pictures courtesy of RHIC website (http://www.bnl.gov/rhic/default.htm)