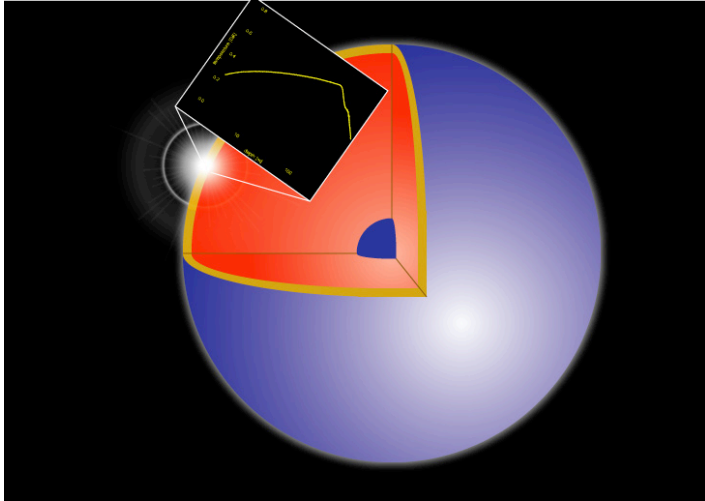


Superbursts Probe Neutron Star Interiors



The above drawing illustrates the structure of a neutron star. Most of the star (indicated by red color) is denser than an atomic nucleus. At the very center (blue) the density is so large that the state of matter is unknown, with several exotic possibilities ranging from deconfined quarks to condensates of elementary particles. This interior is hidden from view by a crust (brown) of “normal” matter: atomic nuclei, free neutrons and electrons. In a neutron star that accretes matter from an ordinary companion star, nuclear reactions on the surface and in the crust can produce bright explosions. In the fast few years, a new type of energetic explosion, known as a *superburst* has been discovered. The superburst ignition is very sensitive to the temperature in the crust (shown in the inset plot), and therefore the rate at which superbursts occur is a thermometer to take the temperature of the neutron star’s core. This provides clues on the nature of matter in the center of the neutron star.

Credit: *E F Brown (Michigan State University, National Superconducting Cyclotron Laboratory and the Joint Institute for Nuclear Astrophysics)*