

WHAT'S A... NEUTRON STAR

A NEUTRON STAR
is the dead core of a
massive star

PROPERTIES

600,000K ~6,000K



100 times hotter
than the Sun

1.1 to 2.1 solar masses



600,000 times
heavier than earth

Neutron Star

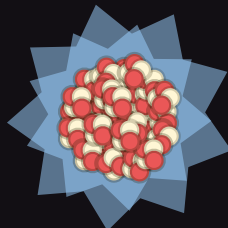
+
Fast rotation
+
Magnetic Field
=
Pulsar!



~600 times smaller
than earth



Density $\sim 10^{17}$ kg/m³



Density of an
atomic nucleus

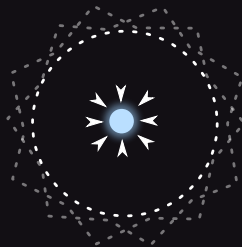
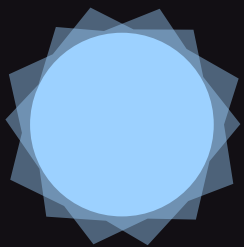
Neutron Star
Mergers



Release Gravitational Waves
and make Gold!

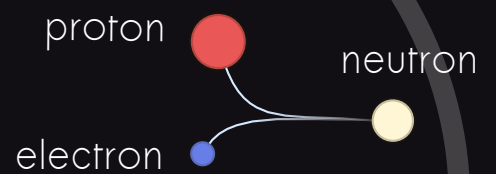
NEUTRON STAR FORMATION

Take a massive Star
> 8 solar masses



At the end of its life, the
core runs out of fuel
and collapses under its
own weight.

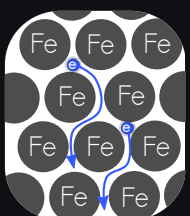
The pressure is such that
protons and electrons
are squashed together
to make neutrons!



And the outer layers
are ejected in a
Supernova explosion

The collapsed core
thus turns into a
Neutron star

NEUTRON STAR STRUCTURE



Lattice of iron nuclei with electrons free
flowing in between. It's incredibly smooth!
With a depth ~500 meters, bumps cannot
be greater than 5mm.



The immense pressure that caused protons and
electrons to merge and form neutrons helps stabilise
large nuclei with an excess of neutron that would
never exist on Earth!



In the outer core, the pressure is such that most
nuclei have dissolved and only neutrons remain. They
form a special phase of matter called "Nuclear Pasta"



No-one knows what is truly at the center of a Neutron
Star! The neutrons might dissolve, leaving only quarks. Or
could it even harbour Strange Matter?!

Outer
Crust

Inner

Crust

Outer

Core

Inner
Core

