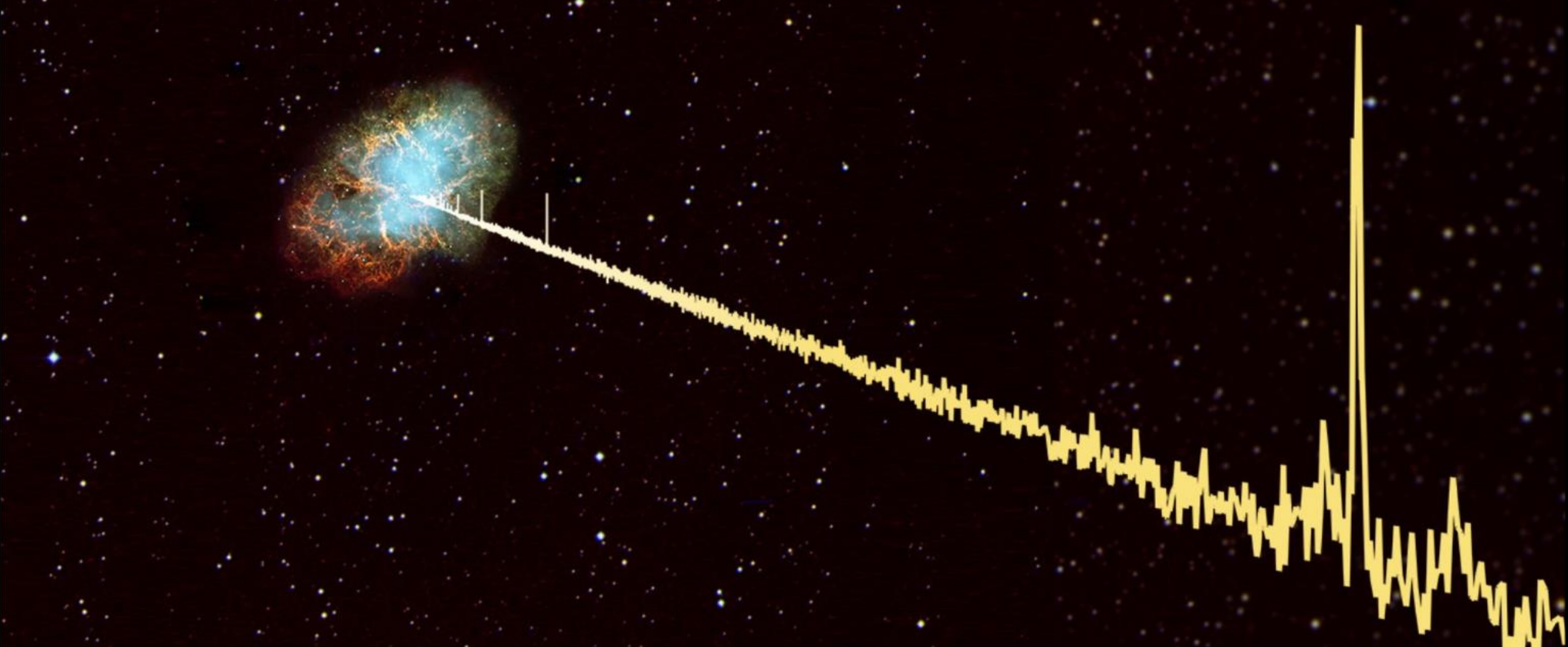


Joeri van Leeuwen

Cutting-edge astronomical research connected to early-teenager science education





Westerbork by night

Animation

Anne Archibald and team

Animation



Anne Archibald and team



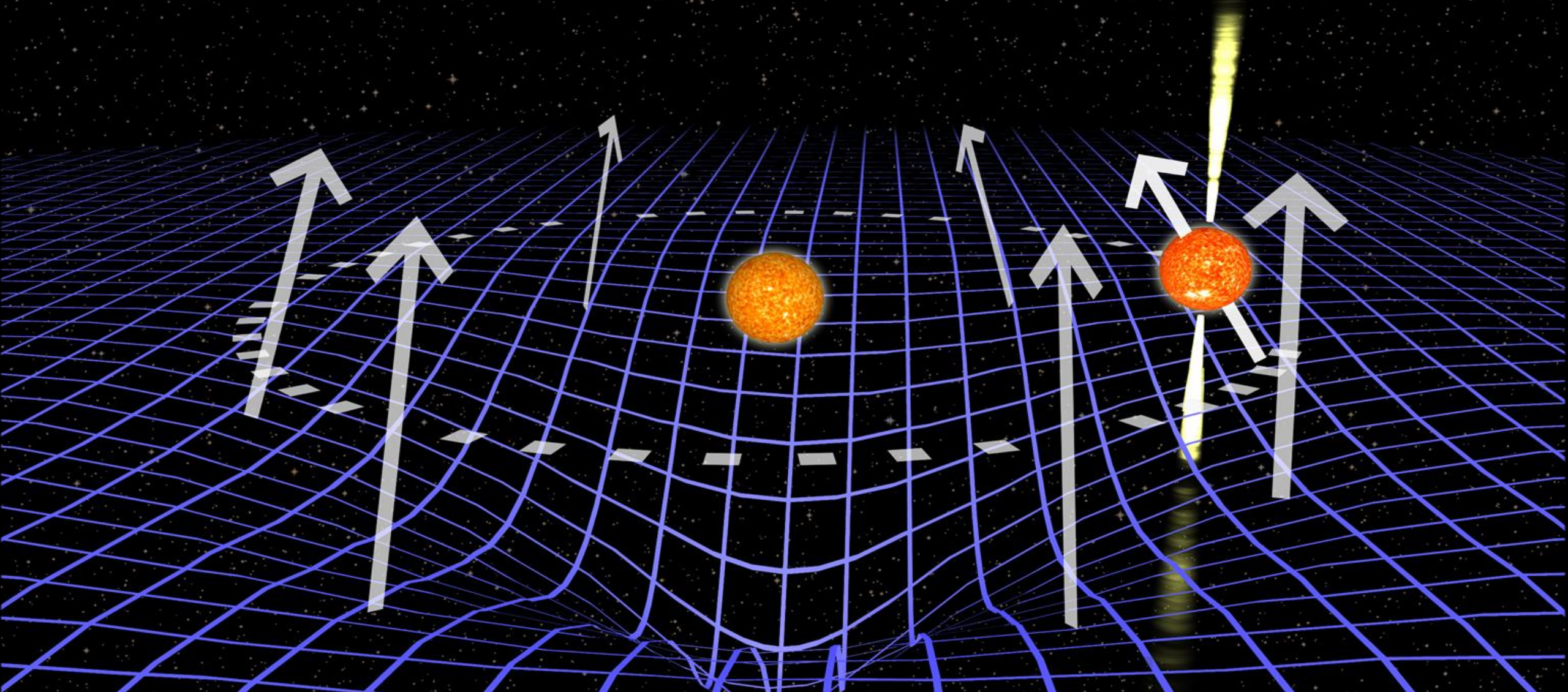
Tom Oosterloo and team

Raffaella Morganti and team



Ger de Bruyn and team

The disappearance of the cosmic spinning top



General Relativity Centennial 1916-2016

*Gravity is intimately linked to the behavior of space and time
on all scales in our Universe.*



Pulsars and the Discovery of PSR J1906+0746

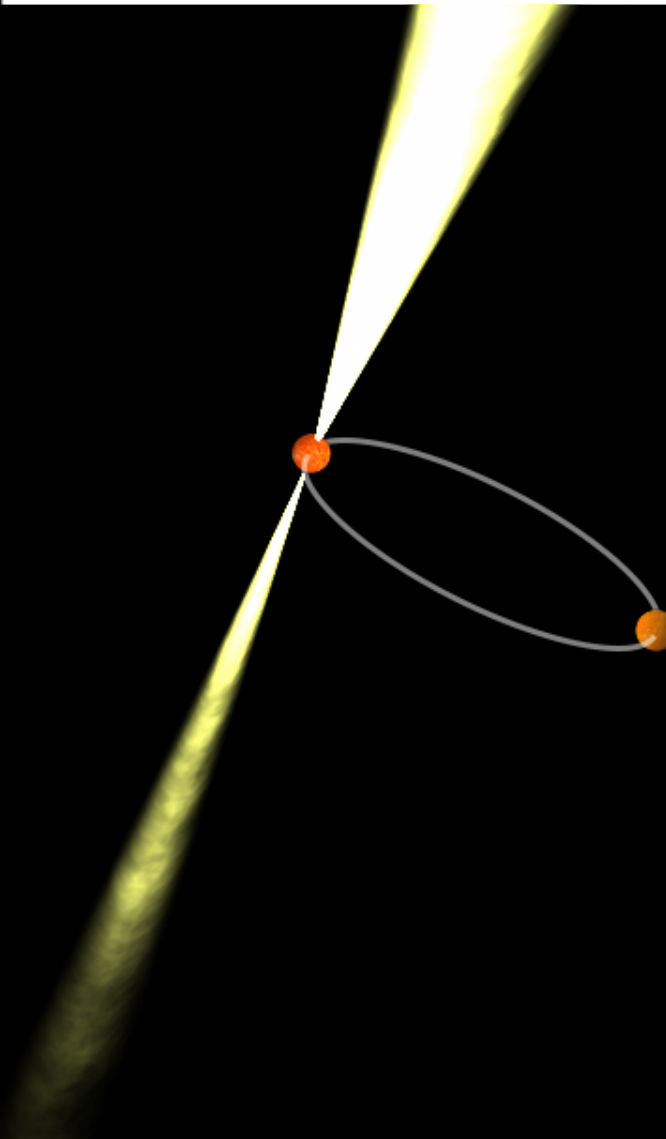
Radio pulsars are neutron stars that shine as radio light houses.

Highest densities visible in the Universe!

Do double duty as their own ultra-precise clocks.



Pulsars and the Discovery of PSR J1906+0746

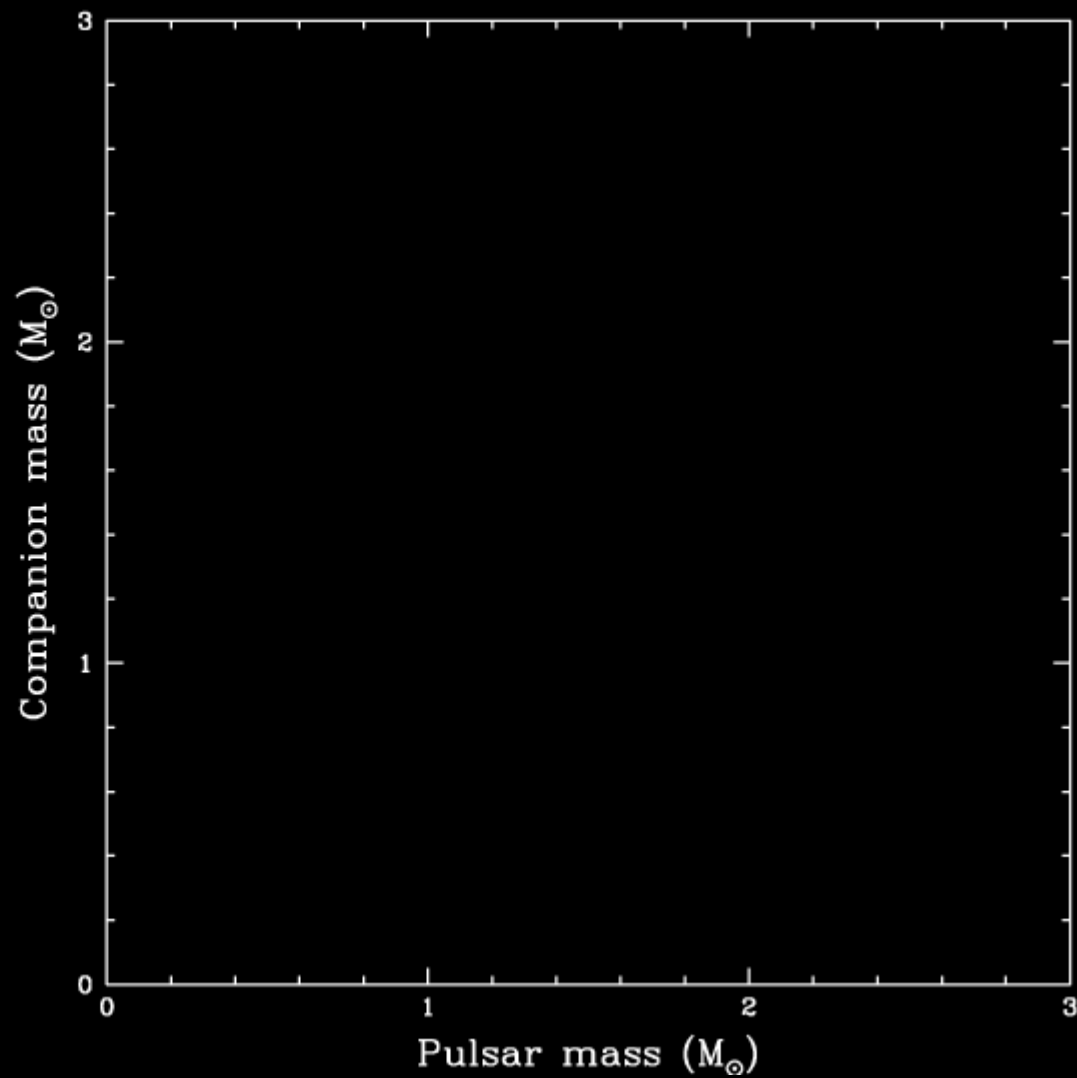
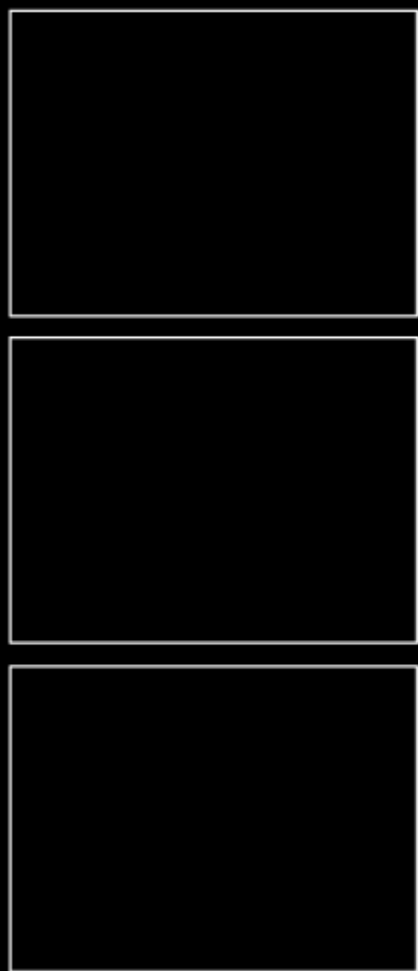


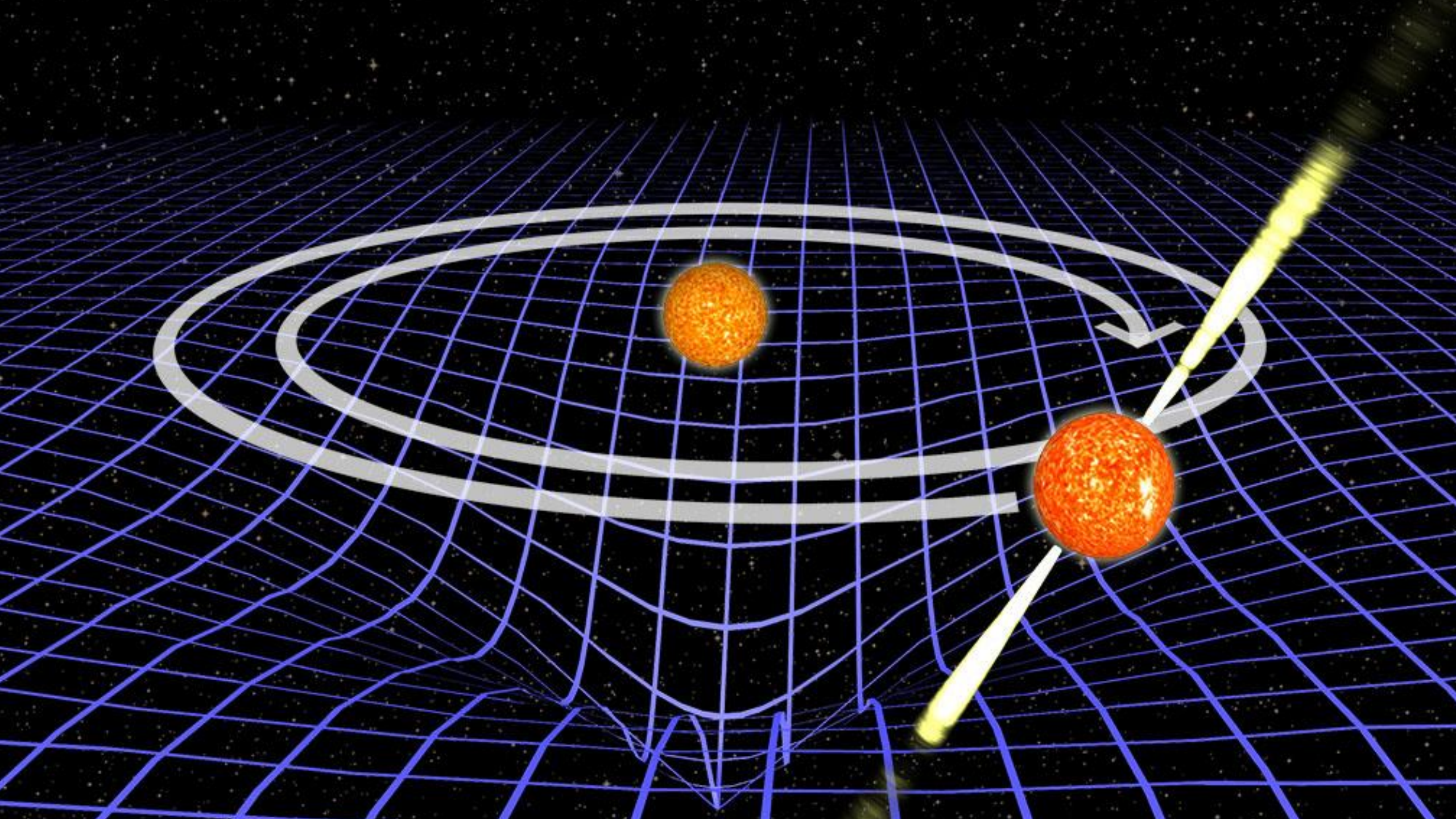
Very bright, fast pulsar, found in 2004, tracked with Westerbork since.

Spins every 144 milliseconds, orbits its companion every 3h59m:
second-most relativistic system known!

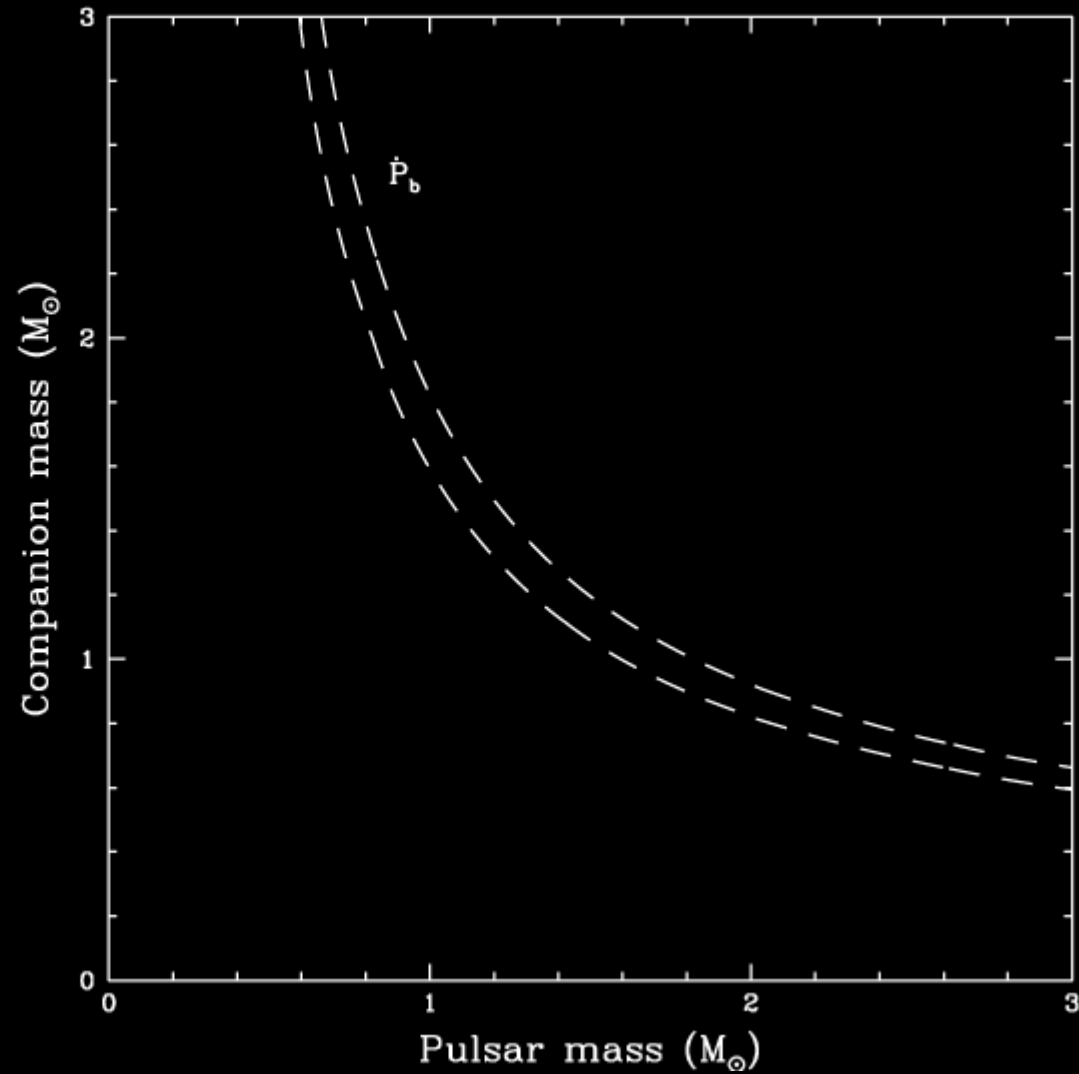
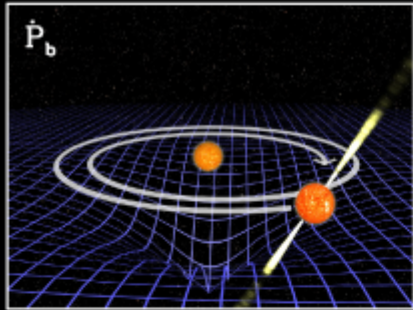
Very young: 100,000 yrs. Practically unchanged since supernova.

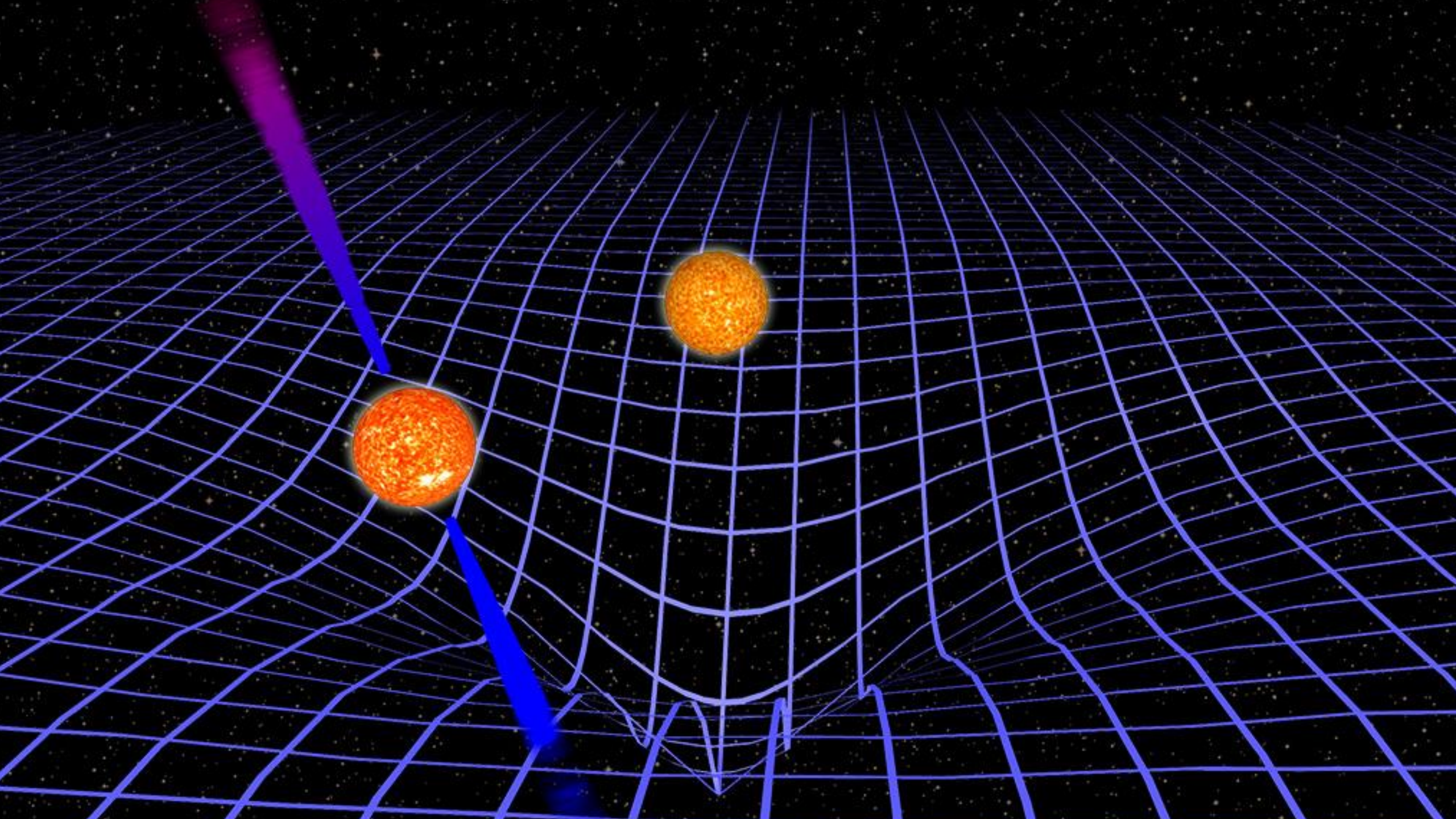
GR Clues and Mass Determination!



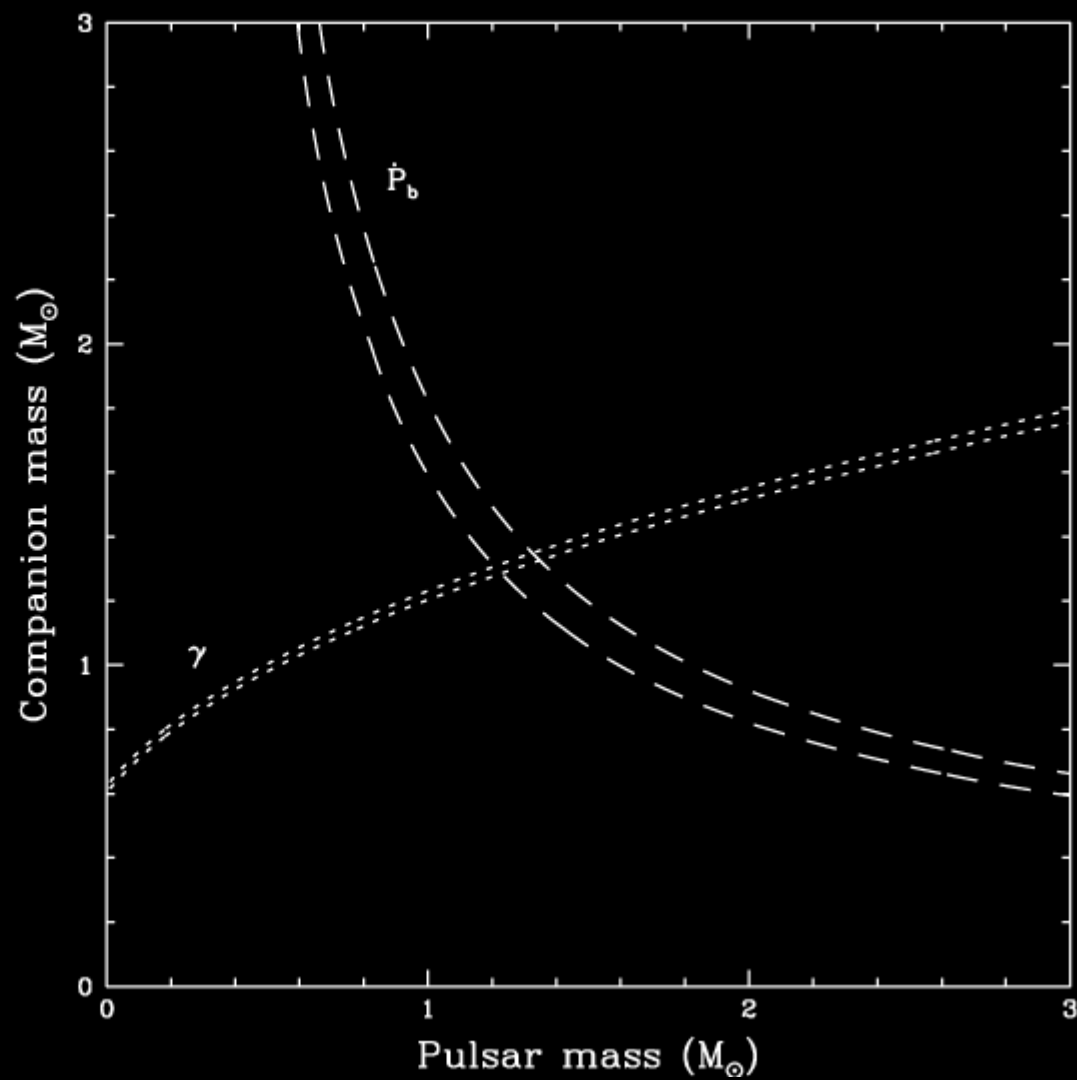
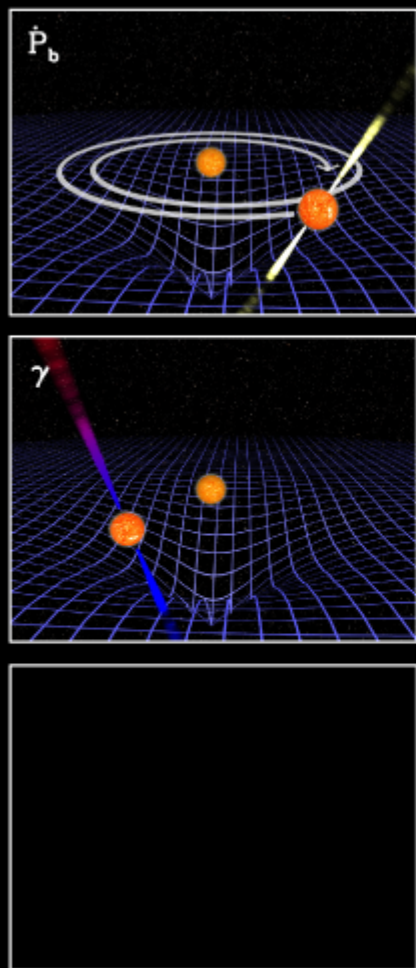


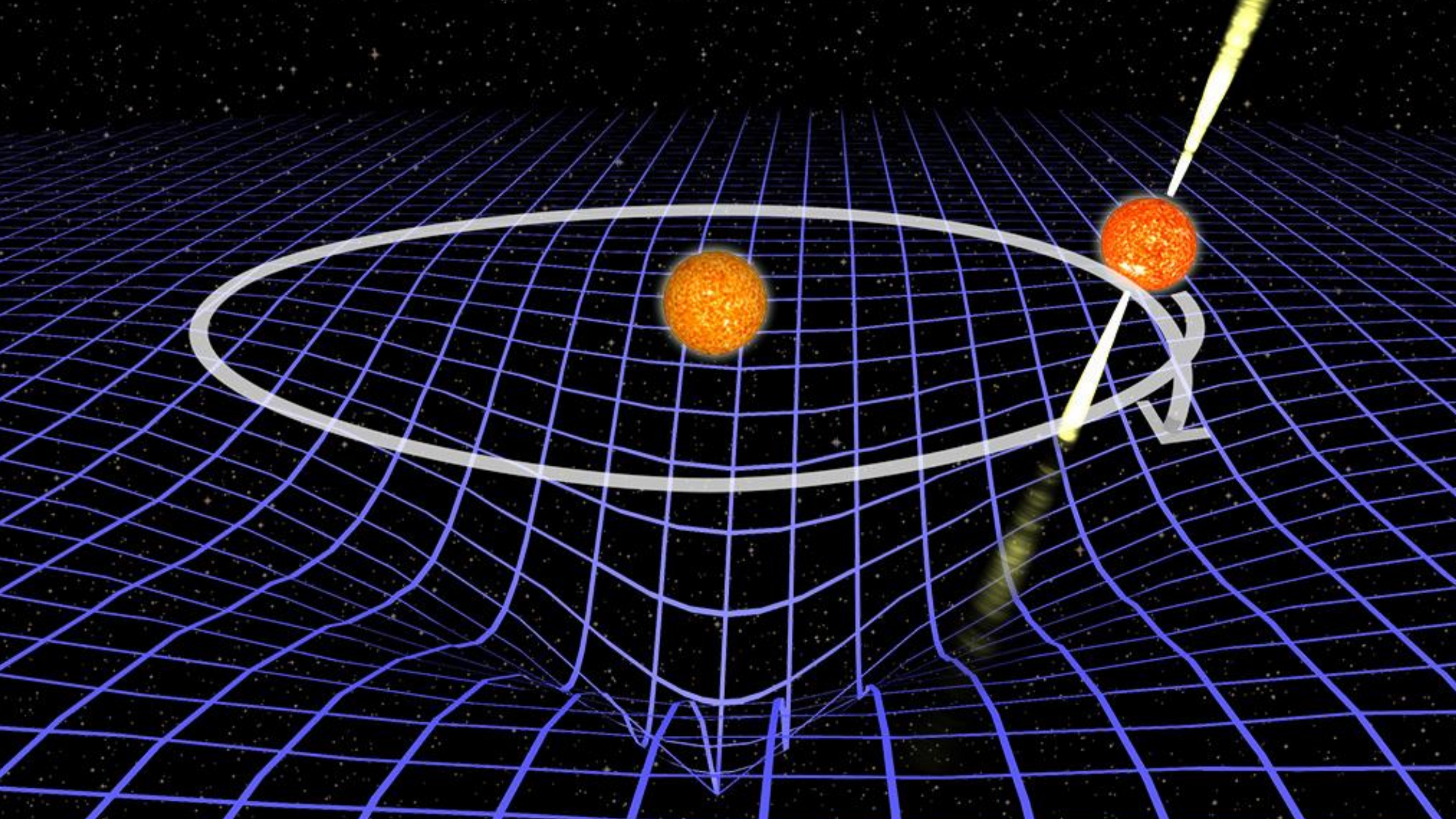
GR Clues and Mass Determination!



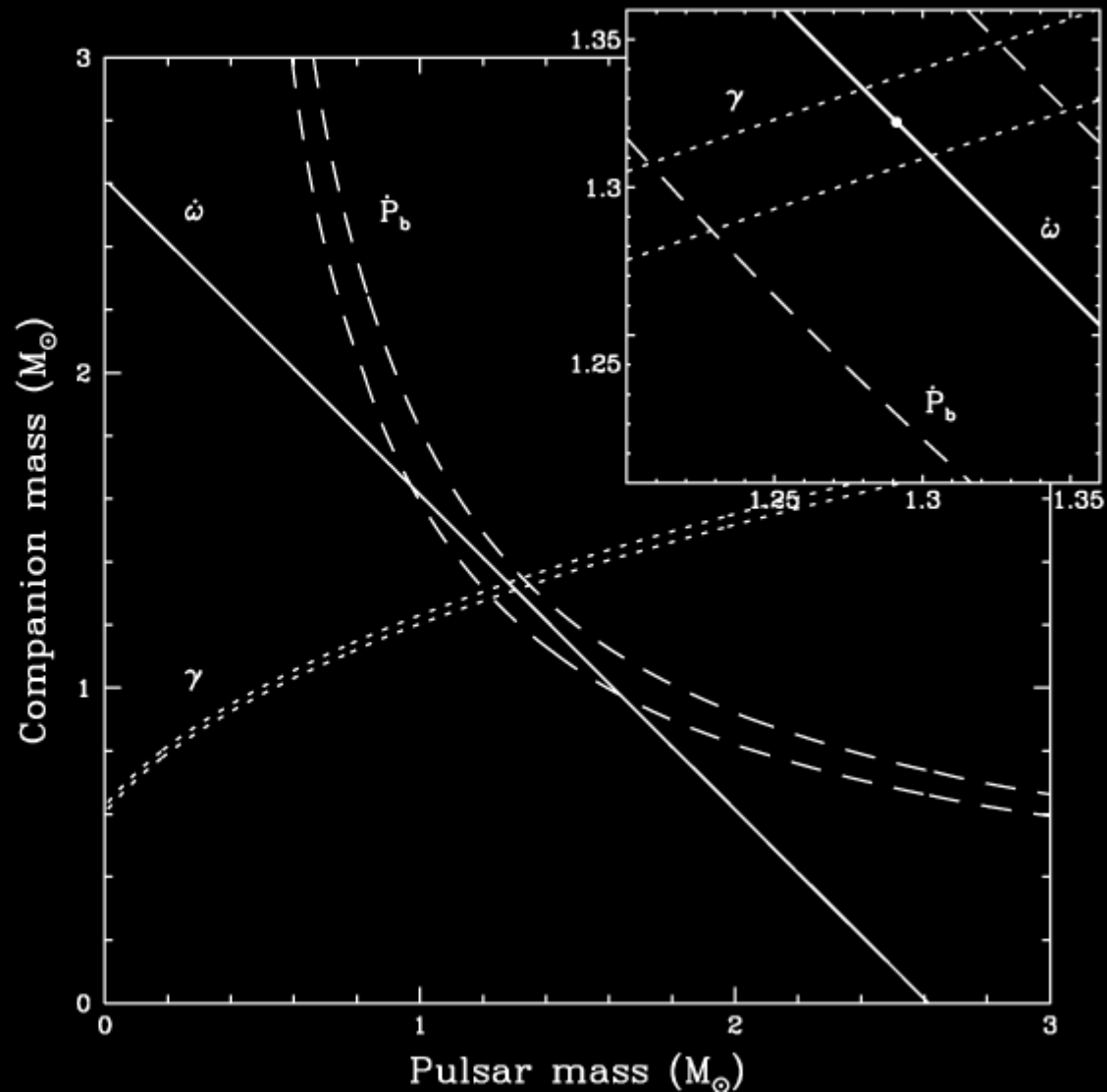
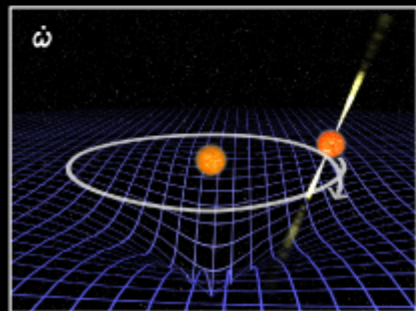
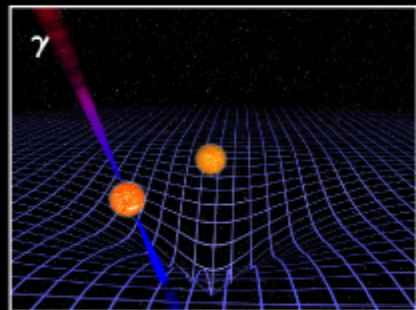
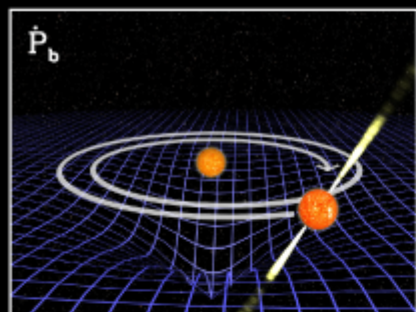


GR Clues and Mass Determination!





GR Clues and Mass Determination!



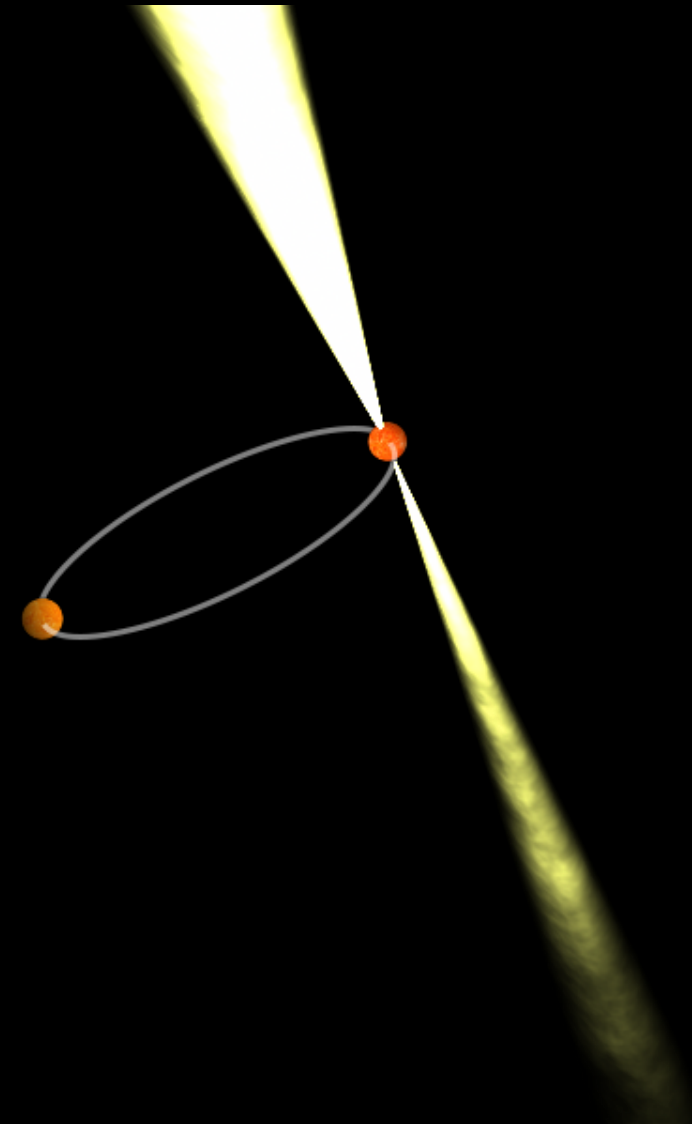
The companion to J1906+0746

Masses are 1.29 Solar masses for the pulsar and 1.32 Solar masses for the ~~acomplice~~ companion.

These masses fit best for double neutron stars, but companion could also still be a white dwarf.

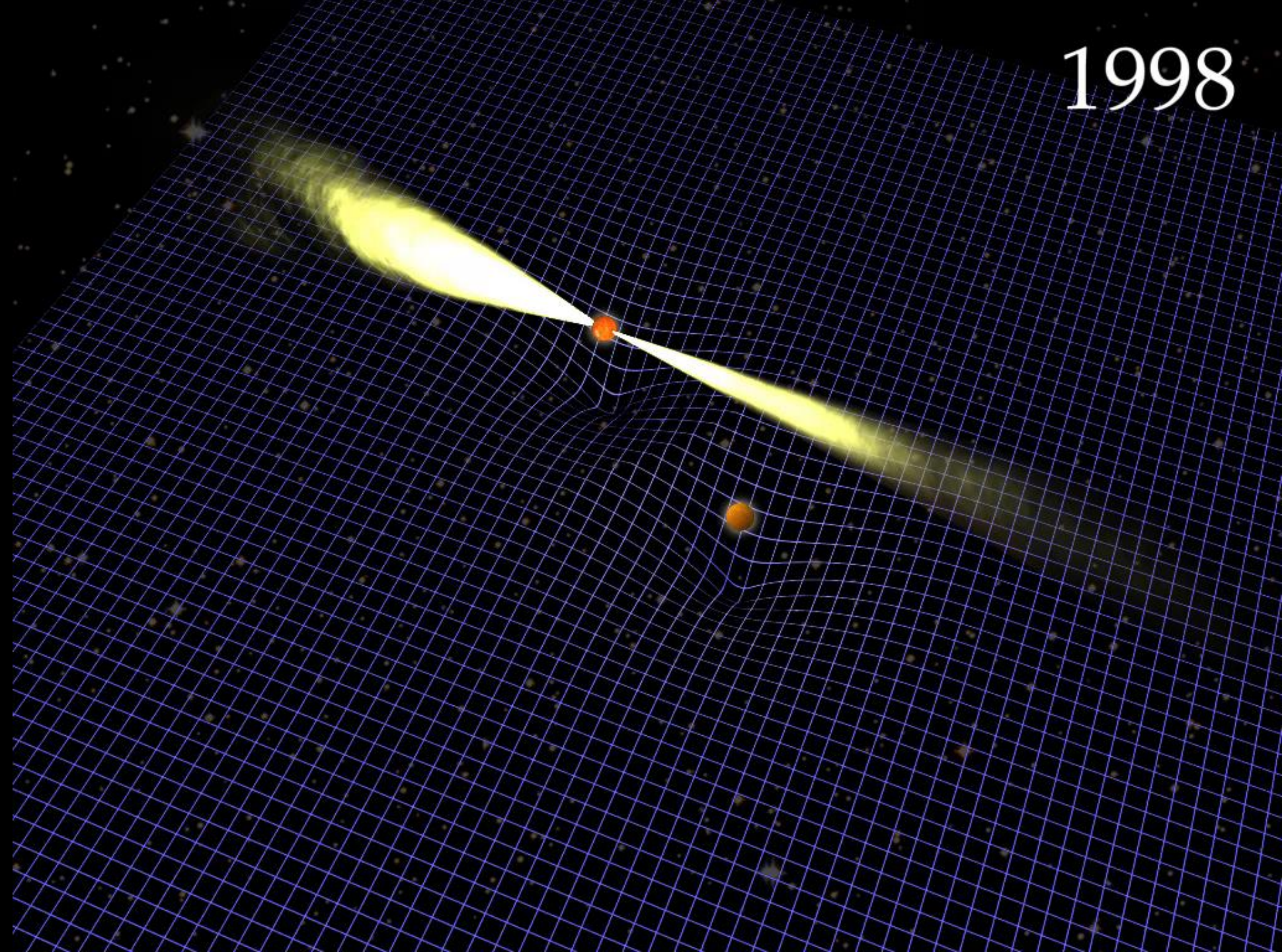
Only in a handful of other double neutron stars have masses been measured, and J1906+0746 is by far the youngest!

These masses predict a geodetic precession of 2.2 degrees per year:





1998



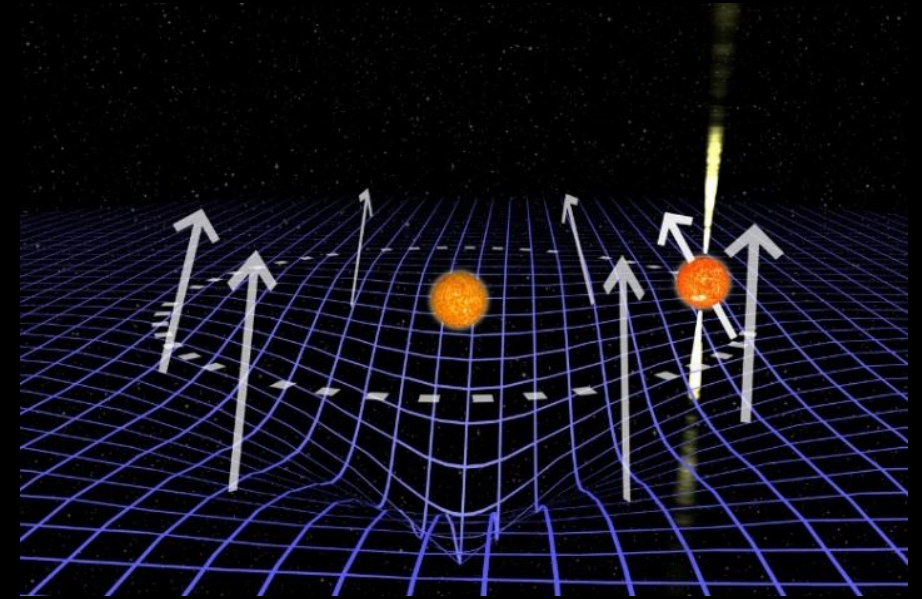
Summary

Westerbork solved the case! Geodetic precession culprit.

Congratulations GR! Three tests combined consistently provided two masses – only a handful of double neutron-star masses are known.

And these agreed with the observed geodetic precession.

The first time such a young pulsar has vanished – these exquisite labs come and go?



European Research Council
Established by the European Commission



APERTIF RADIO TRANSIENT SYSTEM

Van Leeuwen et al. ApJ 2015

Outreach

TV



Internet



Schools



HET KLOKHUIS OVER HET HEELAL



YVONNE SMITS

A green apple with a wooden core and a pile of wood shavings at its base. The apple is positioned centrally against a black background. The core is a light brown, textured wood, and the top half of the apple is a solid green color. A green stem is visible at the top. The text 'HET KLOK HUIS' is written in white, bold, sans-serif capital letters across the wooden core. At the base of the apple, there is a pile of wood shavings and chips, some of which are reddish-brown, suggesting they might be from a specific type of wood.

**HET
KLOK
HUIS**

HET KLOKHUIS OVER HET HEELAL









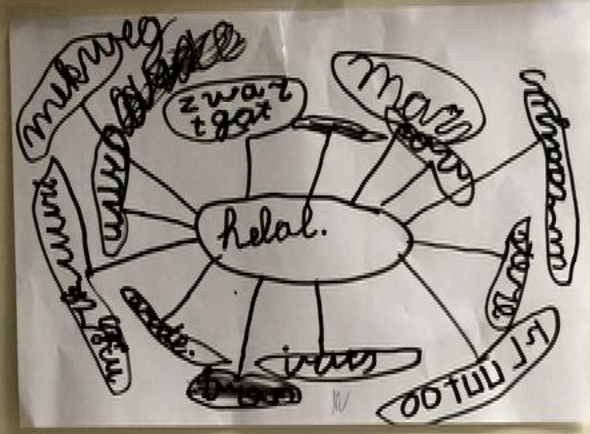
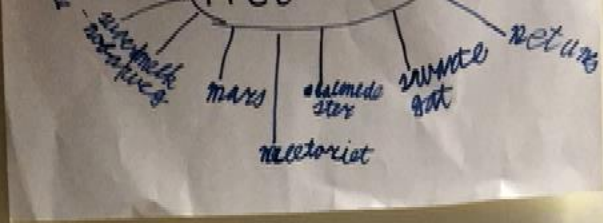
HET KLOKHUIS OVER HET HEELAL











ultraviolet
 zwart gat
 xan
 jurrieten
 het heelal
 stof
 aarde
 maan
 meteoriet
 ster rafel komeet
 melk weg planeten
 geen zwaartekracht
 mensuren



Baete
Casper



LEEVEN

PLANETG

OP planeet

dit ruimte-schip komt uit
planeet 9 en het ruimte-
schip is van eeliejons en
die eeliejons hben iets
spesjals ze kunnen niet
dood door uoderdsom
en het ruimte-schip kan
tegen alles en hij heeft
geen brantstof en
het ruimte-schip heeft
kanonen

9!

