

# Towards mass determination of thermal emitting isolated neutron stars by gravitational lensing

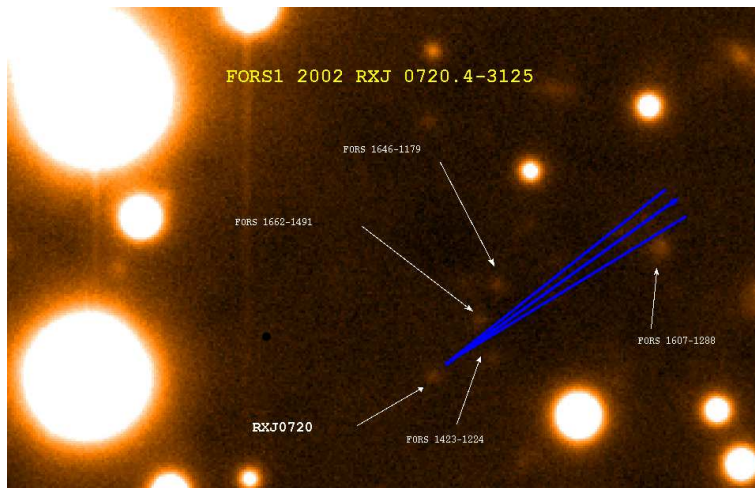
Thomas Eisenbeiss, Ralph Neuhäuser

There are seven thermal emitting, X-ray bright, optically faint, but barely visible neutron stars, so-called Magnificent Seven. Because one can observe their surfaces and atmospheres directly, one can in principle determine their radius which was already successful in the case of RXJ 1856 (Trümper et al. 2004). Most of them also show X-ray pulsations. To constrain the Equation- of-State, one would also need a mass determination.

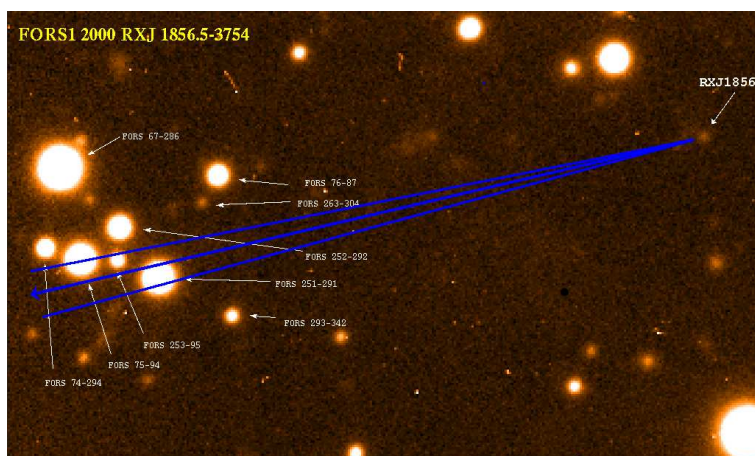
The EoS of neutron stars is important to predict the wave pattern of gravitational radiation emitted in mergers of neutron star binaries, one of the most important sources expected for gravitational wave interferometers like LIGO and VIRGO as well as for astrophysical purposes and fundamental physics.

The determination of neutron star masses so far is limited to binary systems. Another way to obtain this goal could be a gravitational lensing event. In this, we (re)investigated the proper motion of two of the magnificent seven, RXJ 1856.5-3754 (Walter 2001; Neuhäuser 2001) and RXJ 0720.4-3125 (Kaplan et al. 2003) and surrounding field stars, using archival ESO data. While RXJ 0720 passes only some very faint objects in the next decades, RXJ 1856 approaches a dense stellar configuration, hence a microlensing event becomes possible.

Based on this study one could follow the motion of the NSs and of the field stars they are approaching more precisely to ensure or rule out a possible micro lensing event for the future. Furthermore the extension of this investigation to pulsars with known proper motion would increase the target list, although the radius of radio pulsars may remain unconstrained. During the next decades our understanding of the physics of neutron stars may increase, but the possibilities to measure the mass of a single NS may be still limited.



Projected motion of RXJ 0720 (blue arrow). RXJ 0720 passes some very faint objects. Depending on the motion of this faint sources there might be a close encounter around 2031.



Projected motion of RXJ 1856 (blue arrow). RXJ 1856 approaches a dense stellar configuration, hence a microlensing event becomes possible. According to the motion of RXJ 1856 and to the motion of that stars close encounters for the objects FORS1 253-95 and FORS1 75-94 are expected for the years 2105 and 2112 respectively.