Contribution ID: **63** Type: **not specified**

Kinematics, ages, and Equation-of-State of nearby Neutron Stars

We try to constrain the nuclear Equation-of-State (EoS) by observations of neutron stars in our galactic neighbourhood: There are seven thermally emitting neutron stars known from X-ray and optical observations, the so-called Magnificent Seven (M7), which are up to a few Myr old, at 120 to few hundred pc, radio-quiet, but X-ray bright with blackbody-like spectra, so that we can observe their surfaces. As bright X-ray sources, we can determine their rotational (pulse) periods and their period derivatives from X-ray timing. From XMM and/or Chandra X-ray spectra, we can determine their temperatures. With precise astrometric observations using the Hubble Space Telescope, we can determine their parallax (i.e. distance) and optical flux. From flux, distance, and temperature, one can derive the radius. This was recently re-done by us for RXJ1856 and RXJ0720. Then, from identifying atomic or cyclotron absorption lines in X-ray spectra and also from rotational phase-resolved spectroscopy, we can determine the compactness (mass/radius) and/or gravitational redshift. This has also just been successfully applied for one case (RBS1223). If also applied to RXJ1856 or RXJ0720, radius (from optical luminosity and X-ray temperature) and compactness (from X-ray data) will yield the mass and radius - for the first time for an isolated single neutron star without previous mass exchange. We will present our observations and methods as well as recent new results on RXJ0720.

We also trace back the 2- to 3-dimensional motion of young and/or nearby neutron stars in order to find their birth OB association: The flight time is then the kinematic age, a better estimate than the characteristic age from pulse period and its derivative. We compare our kinematic ages with cooling curves, again to constrain the EoS. In some cases, we can also find a runaway star which could have been at the same time at the same place inside an OB association - together with the neutron star, which can be seen as evidence for a supernova in a binary ejecting both the neutron star and the runaway star. Now, we search for supernova debris on such runaway stars by high-resolution optical spectroscopy.

Primary author: Prof. NEUHAEUSER, Ralph (U Jena)

Co-authors: Mr BAHA, Dincel (U Jena); Dr TETZLAFF, Nina (U Jena); Dr HAMBARYAN, Valeri (U Jena)

Presenter: Prof. NEUHAEUSER, Ralph (U Jena)