Neutron Stars and Pulsars about 40 Years after their Discovery

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Review of Poster Contributions II

(Observations)

A. Jessner, MPIfR, Effelsberg

Subjects covered:

1. Instrumentation and Software

2. Short Timescales and Transient Behaviour

3. Long Timescales

4. Spectra and Polarisation

5. Properties of Neutron Stars

6. Neutron Stars and Their Environment

1. Instrumentation and Software

PuMa-II is the next generation pulsar machine that was recently installed and is operating successfully at the Westerbork Synthesis Radio Telescope (WSRT), having 160 MHz Bandwidth and a time resolution of 25ns. => **Karuppusamy, R. (P2)**

A Search for neutron stars in deep optical pointings with m>26 is attempted by =>**Gries, M. (P28)**

(H.E.S.S.) is a system of four, imaging, atmospheric Cherenkov telescopes in Namibia, designed to detect very-high-energy γ-rays above 100 GeV. During 2002–2003, H.E.S.S. collected data from two, young and energetic radio pulsars: the Crab and PSR B1706−44. But no pulsed emission was detected! **=> Noutsos, A. (P26)**

The Gamma Ray Large Area Space Telescope (GLAST) will provide us with a new window (20MeV-300GeV) on the galactic neutron star population **=> Kiziltan, B. (P22)**

The Hough transformation is powerful pattern recognition tool to incoherently detect weak millisecond pulsar candidates in binary orbits. The purpose of the transform is to determine which lines pass through most *features* in an image - that is, which lines fit most closely to the data in the image. **=> Aulbert, C. (P15)**

PulsarSpectrum is a pulsar simulator that that can reproduce γ-ray emission from pulsars with high deatil. Scientists analyzed a set of 55 days of simulated data in order to study GLAST instrument response functions. => **Razzano, M. (P23)**

Observational astronomy produces an ever increasing amount of data with increasing complexity. In his two posters **L. Nicastro (P61, P62)** shows how to organise this deluge with the help of modern database tools.

The Pulsar Virtual Observatory will provide a means for scientists in all fields to access and analyse the large data sets stored in pulsar surveys without specific knowledge about the data or the processing mecha-
nisms. **=> Keith, M. (P31)**

2. Short Timescales and Transient Phenomena

Modern technology enables us to obtain high quality information about the very energetic, but extremely short lived phenomena that may be the actual source of pulsar radio emission. These are often transient in nature, the pulse phase is usually providing only an indication of their probability.

A number of pulsars emits giant radio pulses (**GRP**). In most cases they are characterised by a strong magnetic field (10^4-10^5 G) at the light cylinder,- but not in all of them! **Kuzmin, A.** **(P5)** notes that at least four (B0031-07, B0656+14 B1112+50, J1752+2359) are breaking that rule.

Most famous are GRP's from Crab (B531+21) studied **Eilek, J.** **(P32)** GRPs are seen at all pulse phases at which steady radio emission is evident.
MP and IP GRPs differ in polarization, dispersion, temporal behavior and spectra,- which suggests they differ in their emission mechanisms and their propagation within the magnetosphere!
High time resolution dynamic spectra show that their emission is not broad band, but confined to short lived emission bands

Crab is also famous for its glitches, but these are also evident in slow pulsars, where they help to form a link from high-B PSRs like J1814-1744 to anomalous X-ray pulsars (AXP). => **Jannsen G.** **(P1)**

Soft gamma ray repeaters (SGR) emit very strong X and γ-ray flares.
A particularly strong flare of SGR 1806-20 on December 27th, 2004, was studied by three satellites:
GEOTAIL =>**Tanaka, Y.T.,** **(P55)**
XMM and INTEGRAL => **Tiengo, A.** **(P54)**

More Rotating RAdio Transients (RRATs) were found in the Cygnus OB complex by Westerbork =>**Rubio-Herrera, E.** **(P7)**

Weakly magnetic (B ~10^8G) accreting neutron stars can have jets which eject particles orthogonal to their accretion disk,- forming a microquasar system. Two such candidates, SAX J1808.4-3658 and IGR J00291+5934 show transient radio emission which is related to X-Ray outbursts. => **Massi, M.** **(P47)**

3. Long Timescales (t> P)

Drifting sub pulses are evidence of larger rotating(?) substructures in the radio emission region. They seen in more than 55% of radio pulsars => **Weltevrede. P. (P10)**

PSR B0031-07 is another intriguing source, in addition to GRPs it also shows three stable modes of drifting subpulses, of which only one remains visible at high frequencies,- or as commonly thought further in towards the neutron star. Plasma emission mechanisms were found to be a good model for the observations, however the curvature radiation mechanism did not give a good fit. => **Smits, R. (P46)**

PSR B1259-63 orbits the massive Be Star SS2883 in 3.4 years. The 1.0-10keV X-ray emission was observed from 2001-2004 with ASCA and XMM and found to vary by a factor >10 from periastron to apastron,- an interaction between stellar and pulsar wind is proposed as the cause.
No X-ray pulsations at the 48 ms spin period were observed.=> **Huang H.H. (P17)**

SGR 1900+14 was observed eight times in eight years with BeppoSAX and XMM where it showed rare (two) increases in intensity. There is new evidence for a persistent hard (> 10keV) X-ray tail. **=> Esposito, P. (P53)**

HESSJ1825-137 has been detected in the VHE gamma-ray domain with the H.E.S.S. system. This source has been subsequently associated with the X-ray PWN G18.0-0.7 surrounding the energetic pulsar PSR J1825-1334. Using and adjusting to the VHE and X-ray data one can constrain the magnetic field variation over time as well as the initial pulsar spin-down luminosity .

=> Lemiere, A.C. (P24)

4. Spectra and Polarisation

First direct evidence for turn-over in pulsar radio spectra at high frequencies has been found. New data for some pulsars, taken with the GMRT, show the maximum flux in the spectrum to be > 1 GHz. There seems to be evidence that this peak frequency of turn-over in pulsar spectra appears to depend on dispersion measure and pulsar age. => **Kijak, J. (P3)**

A comprehensive review of spectral properties of ms-psrs and comparisons with slow pulsars are given given by => **Wielebinski, R. (P14)**

The luminosity difference between isolated and binary ms-psrs has been confirmed. There is a possibility that isolated MSPs have undergone more magnetic field decay than their binary counterparts and are therefore less luminous. => **Lommen, A. (P12)**

INTEGRAL observed B0540-69 in the LMC in the 3-300 keV range. Pulsed emission is visible up to 100keV, but above the pulsed signal vanishes.
A. Slowikowska (P19)

Radio, X-ray, and H.E.S.S. gamma-ray observations of the galactic center composite SNR G0.9+0.1 are used to constrain a timedependent injection model of the electron spectrum responsible for the total multi-wavelength spectrum and its implication for the evolutionary history of spin-down power.=> **Venter, Chr. (P30)**

The 0.3-10.0 keV spectrum of Anomalous X-ray Pulsar J1708-4009,- observed with Chandra, is fitted by a power-law plus blackbody model, as seen in the earlier BeppoSAX and XMM-Newton observations. However Chandra data does not confirm the 8.1 keV absorption feature seen in the previous BeppoSAX observation, in either the phase-integrated, or in the phaseresolved spectra.
=> Sutaria, F. (P52 or P52?)

5. Properties of Neutron Stars

Spectroscopic and photometric observations of the optical counterpart to PSR J1911–5958A, a millisecond pulsar located toward the globular cluster NGC6752, were used to constrain the pulsar mass to $M_{PSR} = 1.34 \pm 0.08\ M_{Sun}$ and radius and the mass of the He white dwarf to $R_{WD} = 0.058 \pm 0.004 R_{Sun}$ and $M_{WD} = 0.175 \pm 0.010 M_{Sun}$. The white-dwarf radius determined from the spectrum and the systemic radial velocity of the binary are inconsistent with the values that are expected if PSR J1911–5958A is associated with NGC6752. So far observations do not conclusively confirm nor disprove the association of the pulsar binary with the globular cluster => **Bassa, C. (P11)**

6. Neutron Stars and Their Environment

The addition of large amounts of dark gas in the interstellar emission background has recently led to a substantial revision of the EGRET catalogue of γ-ray sources. A comparison of their spatial and flux distribution with simulated populations of radio and X-ray psrs has been made. => **Grenier, I. (P21)**

A bow shock nebula with a steep spectrum (photon index 2.3) was discovered around the black widow pulsar B1957+20 in an 30 ksec XMM-exposure, => **Huang, H.H.(P18)** A solitary ms pulsar J2124-3358, was found to be surrounded by an 0.5 arcmin nebula with similar photon index. => **Hui, C.Y. (P16)**

Multiwavelength observations of the northern sky pulsar wind nebula 3C58 were used to derive a nebular field strength around 10 μG, which is well below the equipartition value of 80 μG. **=> Aliu E. (P29)**

An analysis and interpretation of the X-ray light curve of the accreting neutron star Her X-1 obtained with the ASM RXTE over the period 1996 February to 2004 September was used to support the model of a tilted precessing accretion disk around the neutron star. => **Klochkov, D. (P59)**

Observations of a strong and extended positron-electron annihilation line emission in the Galactic center (GC) region by the SPI/INTEGRAL are challenging to the existing models of positron sources in the Galaxy. The $e^{\pm}$ pairs from pulsars winds can contribute significantly to the positron sources in the Galactic center region and the intensity of the annihilation line should correlate to the mass distribution of ms-psrs and hence the mass distribution in the GC. **=> Wang, W. (P27)**

Precision astrometry campaigns with the Very Long Baseline Array yield model-independent distances and velocities to neutron stars. PSR B1508+55, has a transverse velocity of 1100±100 km s^{-1}, the highest velocity directly measured for a neutron star. Binary disruption alone is insufficient to impart the required birth velocity. Not only is a natal kick indicated, but the extreme velocity challenges current simulations of supernova core collapse. => **Vlemmings, W. (P8)**

Pulsars and neutron stars are a crucial node in our matrix of knowledge about the physical world.

Because Pulsars and neutron stars are such extreme objects, we need a comprehensive approach in our attempt to understand them, with contributions of all branches of theoretical physics as well as from the observers with their sophisticated instrumentation and software.

This is amply reflected in the wide range of today's poster contributions!