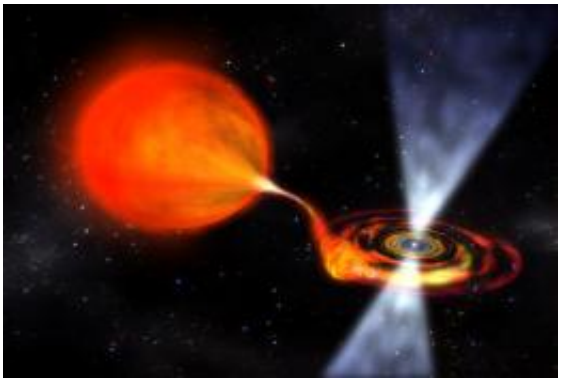
School students help astronomers study mysterious X-ray source

April 20 2011



This is an artist's impression of a spinning neutron star (pulsar) approximately 20 kilometres in diameter, accreting material from a companion star. The strong gravity from the dense pulsar attracts material from the companion. The flow of gas from the companion to the pulsar is energetic and glows in X-ray light. Credits: NASA/Dana Berry

(PhysOrg.com) -- Astronomers from Wales and the Netherlands, in collaboration with five schools, have used eight telescopes simultaneously to study the strange behaviour of an X-ray binary star system. Results were presented by postgraduate student Fraser Lewis at the RAS National Astronomy Meeting in Llandudno, Wales, on Monday 18th April.

IGR J00291+5934 ('00291') is a rare X-ray binary system containing a pulsar – a neutron star spinning several hundred times per second – and a

normal star. Only 12 such systems are known. In September 2008, 00291 increased in brightness at X-ray wavelengths by a factor of at least a thousand times and in visible wavelengths by a factor of around a hundred times. While this type of outburst is not uncommon for this type of system, the timescale is usually months to years. However 00291, having been in outburst for 20 days, faded away to its normal faint state but then re-brightened within 30 days.

"We had never seen this rapid a turnaround in a system of this type before" said Lewis, of the Faulkes Telescope Project at the University of Glamorgan. "To try to understand what was driving this unique behaviour, we gathered data from several telescopes, at different wavelengths, to create a dataset of unprecedented detail."

The group, led by Lewis and Dr. David Russell, of the University of Amsterdam, used data from Faulkes Telescope North, the Isaac Newton Telescope and the Keck Telescope (optical wavelengths), PAIRITEL (infrared), the Westerbork Synthesis Radio Telescope (radio), the Swift GRB mission (UV and X-ray), and the XMM-Newton and RXTE satellites (X-ray). Five schools, including St. Brigid's School, Denbigh and St Davids College, Cardiff, were involved in collecting the data using Faulkes Telescope North.

In X-ray binary systems, material from the star spirals in towards the pulsar, forming an accretion disc. Friction and gravity heat this material up until it reaches temperature of millions of degrees and emits X-rays.

"The behaviour of 00291 is baffling. Outbursts are thought to be driven by the 'emptying' of the accretion disc, which means that the time between outbursts indicates the time that it takes to fill the disc, and the size of the disc itself. However, for a system as compact as 00291, it’s unlikely that it could replenish its supply within 30 days," said Lewis.

To find a solution to this mystery, Lewis and Russell have turned to a group at the Naval Research Laboratory in Washington led by Dr. Jacob Hartman. Hartman's group suggests that the outburst is all one event that was interrupted halfway through by a propeller effect.

"The idea is that when the 'propeller' switches on, the material that was spiralling inwards becomes ejected from the system, stopping the outburst. Then the propeller switches off again, the outburst restores itself. However, there are still many things that we don't understand," said Lewis.

These results are presented within the wider context of an extensive optical monitoring program of 32 low-mass X-ray binaries using the 2-metre Faulkes Telescopes in Hawaii and Australia.

Provided by Royal Astronomical Society