beam was sent into a 20-cm long cryogenic aluminum target vessel containing either hydrogen or ^{4}He in Jefferson Lab's Hall A. Septum magnets then deflected elastically scattered electrons, which were at a forward angle of 6°, to the Hall A High Resolution Spectrometers (HRS), located at 12.5°.

The HRS allowed a very clean separation of elastic events, with an average value of momentum-transfer squared, $Q^2 = 0.1$ $(GeV/c)^2$. A Cherenkov electromagnetic shower calorimeter covered the distribution of elastic events in the spectrometer focal plane. The signal was integrated over each period of constant helicity. A blinding factor was placed on the data and removed only a week before the result was presented in Dallas.

The HAPPEx results indicate small values for the strange form factorss $G^s_M = 0.12 \pm 0.24$ and $G^s_E = -0.002 \pm 0.017$. While these results are consistent with previous results from HAPPEx (Aniol *et al.* 2006) and world data, they reveal that the large values and possible radical Q^2 dependence of the strange form factors suggested by previous data in this kinematic region, are highly unlikely. Also, while these new data are accurate enough to eliminate many models of strangeness content, they do not rule out sizable contributions at higher Q^2. They are also compatible with a new analysis of world data, the result of which is in excellent agreement with modern calculations based on non-perturbative quantum chromodynamics using lattice methods and chiral extrapolation (Young *et al.* 2006).

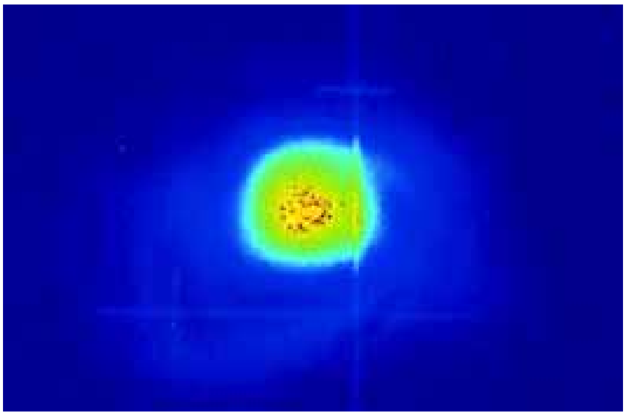
Further Reading

K. A. Aniol *et al.*, Phys. Lett. **B** 635, 275 (2006) and Phys. Rev. Lett. **96**, 022003 (2006).

R. D. Young *et al.*, www.arXiv.org/abs/nucl-ex/0604010 (2006), submitted to Phys. Rev. Lett.

FLASH Produces the Shortest Wavelength yet[2]

On 26 April, the vacuum-ultraviolet and soft X-ray free-electron laser (FEL) facility at DESY generated pulses at the shortest wavelength yet, using electron bunches supplied by the TESLA Test Facility (TTF) linac. The laser facility already produced the shortest wavelengths achieved with a FEL, with pulses at 32 nm. Now it has reached a new record with a wavelength of only 13.1 nm.



Single-shot image taken when the radiation pulse at 13 nm from DESY's free-electron laser hits a scintillating Ce:YAG crystal. (Courtesy DESY Hamburg.)

Equipped with five superconducting accelerator modules, the TTF linac can accelerate electron bunches to an energy of 700 MeV. This is sufficient for the bunches to emit laser pulses at 13.1 nm as they subsequently traverse the undulator. A sixth module, to be installed in 2007, will allow a further increase in energy to 1 GeV, making it possible to generate wavelengths as low as 6 nm. The pulses produced are shorter than 50 fs, leading appropriately to the new name for the facility, FLASH, which was chosen to be simpler and more attractive than VUV-FEL.

After a successful first data-taking run that ended in February, on 8 May the newly named FLASH began once again to serve its users for a second measuring period.

MAGIC Discovers Variable Very-High-Energy Gamma-Ray Emission from a Microquasar[3]

The Major Atmospheric Gamma-ray Imaging Cherenkov (MAGIC) Telescope has discovered variable very-high-energy gamma-ray emission from a microquasar. The telescope, on the island of La Palma, observed the microquasar called LS I +61 303 between October 2005 and March 2006. The observations show a clear variation with time and suggest that gamma-ray production may be a common property of microquasars.

Microquasars are gravitationally bound binary-star systems consisting of a massive ordinary star and a compact object of

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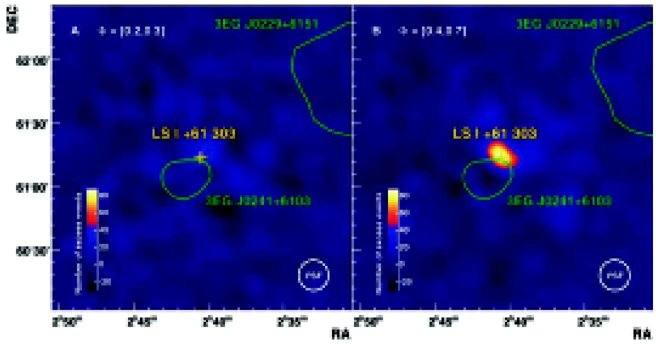
[3] *The permission for reprinting the present report, as published previously in CERN Courier, Vol. 46, No. 6, July/August 2006, was granted through CERN Courier, http://www.cerncourier.com/.*



Map of gamma rays measured by MAGIC around the location of LS I +61 303 at two different points along the orbital cycle. Left: when the two stars are closest to one another (periastron passage). Right: a third of an orbit away from the periastron passage.

a few solar masses that is either a neutron star or a black hole. The two stars orbit a common centre and when close enough the mutual tides can cause a sudden transfer of mass from the normal star onto the compact companion. Some of the gravitational energy released in this exchange gives rise to jets of particles ejected at close to the speed of light, together with spectacular emission of radiation. Microquasars appear to be scaled-down versions of quasars, but in this case the small mass of the compact object means that events occur on a much smaller timescale — days rather than years — making them interesting objects to study. They are also a possible source of high-energy cosmic rays.

MAGIC detected LS I +61 303, one of about 20 known microquasars, at a rate of one gamma ray per square metre per month (Albert 2006). The telescope registers gamma rays through the Cherenkov radiation produced by the showers of particles created by the gamma rays as they enter the atmosphere (see CERN Courier, December 2003, p, 7).

LS I +61 303 was observed over six orbital cycles and a clear variability was found that is consistent with the orbital changes in aspect of the compact object (see figure). There is also evidence of periodicity. This shows that the very-high-energy gamma-ray emission is directly related to the interaction between the two stars.

Further Reading
J. Albert *et al.*, Science **312**, 1771 (2006).

Quasar Jets could Be Powerful Accelerators[4]

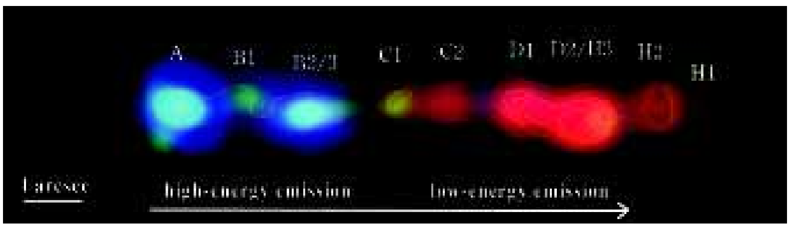
Complied by Marc Türler[5]

Infrared observations of the quasar 3C 273 by the Spitzer Space Telescope are giving new insight into the physics at play in its large-scale jet. The new images, combined with complementary radio, optical and X-ray observations, reveal two distinct spectral components. There is evidence that the component emitting X-rays is also producing synchrotron radiation, implying that ultra-energetic particles are continually accelerated all along the jet.

Back in 1963, 3C 273, an apparently faint star with associated radio emission, was found to be at a cosmological distance (redshift of 0.158). This implied that this “quasi-star”— the first identified quasar — was about 100,000 billion times more luminous than the Sun. It is also the brightest of this class of extreme active galactic nuclei, which completely outshine their host galaxies. At the time of discovery, deep optical images of 3C 273 revealed a faint jet with an extension of about 100,000 light-years ending at the exact position of a second radio source.

More than 40 years later, the detailed structure of this jet has been studied by NASA’s three great observatories: in visible and ultraviolet light by the Hubble Space Telescope, in X-rays by the Chandra Observatory and now also in the infrared by the Spitzer Space Telescope. This, together with radio observations by the Very Large Array (VLA), enables this powerful jet to be studied across the whole electromagnetic spectrum.

A team led by Y Uchiyama at Yale University has now shown that the overall spectrum of individual bright features in the jet contains two distinct spectral components. The first component extends from the radio to the infrared and the second becomes dominant in the visible up to the X-rays. While the low-energy component is undoubtedly of synchrotron origin



Composite image of the jet of 3C 273 made from images in infrared (shown as red) and visible (green) obtained by the Spitzer and Hubble space telescopes, and in X-rays (blue) by the Chandra satellite. The superimposed radio-map contours are from the VLA. Letters label the main structures along the jet; knot A is closest to the quasar (Y. Uchiyama et al.).

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