Heart of a galaxy emits gamma rays

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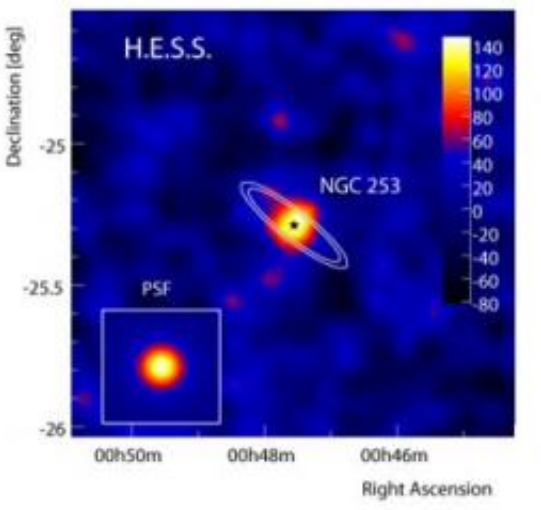

Heart of a galaxy emitting gamma rays: This image taken with H.E.S.S. shows the heart of the NGC 253 galactic system. The black star marks the optical centre and the white contours indicate the shape of the galaxy. The H.E.S.S. telescope system perceives the centre of the galaxy as a point - as the comparison with a simulated artificial point source in the inset ("PSF") shows. Credit: Image: H.E.S.S. Collaboration

(PhysOrg.com) -- Quite a few distant galaxies turn out to be cosmic delivery rooms. Large numbers of massive stars are born in the hearts of these starburst galaxies, and later explode as supernovae. In the remnants they leave behind, particles are accelerated to very high energies. Astrophysicists have now used the H.E.S.S. telescopes to make detailed measurements of the gamma rays from the NGC 253 galaxy. As predicted, these high-energy rays originate from the region of maximum

supernova activity close to the centre. (*Science Express*, September 2009)

At a distance of some twelve million light years away, NGC 253 is one our closest spiral galaxies outside the so-called local group of our Milky Way and its companions. Observations in the visible light as well as in the infrared and radio frequency ranges had already shown there was a small region at the centre of NGC 253 which gave birth to a very high number of stars. This region exhibits a very high density of interstellar dust and gas.

The high-mass stars born in this region use up their nuclear fuel relatively quickly and stagger into an energy crisis at the end of their life. The nucleus collapses while the star destroys itself in one final explosion. Such a supernova suddenly flares up a million or even a billion times brighter than before. The charged particles accelerated to very high energies in the remnants of such explosions react with the surrounding medium or with electromagnetic fields to generate extremely high-energy gamma quanta.

Between 2005 and 2008, astrophysicists used the H.E.S.S. telescope system in Namibia over a total observation period of 119 hours to detect the expected gamma rays at energies exceeding 220 GeV (billion electronvolts). The source of these rays lies precisely at the optical centre of NGC 253 and appears as a point to H.E.S.S. This makes it the weakest source discovered to date in the very high-energy gamma radiation range.

The flux of radiation from the starburst region of NGC 253 measured by H.E.S.S. implies an enormous cosmic ray density - more than 1,000 times higher than at the centre of the Milky Way. Moreover, the high gas density makes the conversion of cosmic rays into gamma rays around one order of magnitude more efficient. Accordingly, the central region of NGC 253 shines around five times as brightly in the light of gamma

rays as all the rest of the galaxy together.

H.E.S.S. Telescopes

The four H.E.S.S. telescopes, each with a mirror area of 108 square metres, observe weak bluish and extremely short flashes of light. This so called Cherenkov radiation is emitted by showers of particles created when high-energy gamma quanta collide with molecules in Earth's atmosphere. H.E.S.S. stands for High Energy Stereoscopic System and has been in operation since the beginning of 2004. Since this time it has made many important discoveries, such as the first astronomical image of a supernova remnant in the high-energy gamma radiation range, or the detection of galaxies with active nuclei in the light of gamma rays. The fifth, much larger telescope that is currently under construction will significantly improve the sensitivity of the system and extend the observable energy range. The H.E.S.S. collaboration under the overall lead management of the Max Planck Institute for Nuclear Physics involves more than 150 researchers from Germany, France, Great Britain, Poland, Czech Republic, Ireland, Austria, Sweden, Armenia, South Africa and Namibia.

More information:

• F. Acero, F. Aharonian et al. Detection of Gamma Rays From a Starburst Galaxy , Science Express, September 24, 2009

• The H.E.S.S. Homepage at the MPI for Nuclear Physics

Source: Max-Planck-Gesellschaft (news : web)