

# Stellar Vampires Unmasked

## VLT Presents Evidence for Mass Transfer as Origin of some Blue Straggler Stars

Astronomers have found possible proofs of stellar vampirism in the globular cluster 47 Tucanae. Using ESO's Very Large Telescope, they found that some hot, bright, and apparently young stars in the cluster present less carbon and oxygen than the majority of their sisters. This indicates that these few stars likely formed by taking their material from another star.

*"This is the first detection of a chemical signature clearly pointing to a specific scenario to form so-called 'Blue straggler stars' in a globular cluster",* said Francesco Ferraro, from the Astronomy Department of Bologna University (Italy) and lead-author of the paper presenting the results.

Blue stragglers are unexpectedly young-looking stars found in stellar aggregates, such as globular clusters, which are known to be made up of old stars. These enigmatic objects are thought to be created in either direct stellar collisions or through the evolution and coalescence of a binary star system in which one star 'sucks' material off the other, rejuvenating itself. As such, they provide interesting constraints on both binary stellar evolution and star cluster dynamics. To date, the unambiguous signatures of either stellar traffic accidents or stellar vampirism have not been observed, and the formation mechanisms of Blue stragglers are still a mystery.

The astronomers used ESO's Very Large Telescope to measure the abundance of chemical elements at the surface of 43 Blue straggler stars in the globular cluster 47 Tucanae [1].

They discovered that six of these Blue straggler stars contain less carbon and oxygen than the majority of these peculiar objects. Such an anomaly indicates that the material at the surface of the blue stragglers comes from the deep interiors of a parent star [2]. Such deep material can reach the surface of the blue straggler only during the mass transfer process occurring between two stars in a binary system. Numerical simulations indeed show that the coalescence of stars should not result in anomalous abundances.

In the core of a globular cluster, stars are packed extremely close to each other: more than 4000 stars are found in the innermost light-year-sized cube of 47 Tucanae. Thus, stellar collisions are thought to be very frequent and the collision channel for the formation of blue stragglers should be extremely efficient. The chemical signature detected by these observations demonstrates that also the binary mass-transfer scenario is fully active even in a high-density cluster like 47 Tuc.

*"Our discovery is therefore a fundamental step toward the solution of the long-standing mystery of blue straggler formation in globular clusters,"* said Ferraro.

Measurements of so many faint stars are only possible since the advent of 8-m class telescopes equipped with multiplexing capability spectrographs. In this case, the astronomers used the FLAMES/Giraffe instrument that allows the simultaneous observation of up to 130 targets at a time, making it ideally suited for surveying individual stars in closely populated fields.

### More information

The results described in this press release is presented in a Letter to the Editor of the *Astrophysical Journal* on 10 August 2006 ("Discovery of Carbon/Oxygen depleted Blue Straggler Stars in 47 Tucanae: the chemical signature of a mass-transfer formation process" by F.R. Ferraro et al.). The team comprises Francesco R. Ferraro and Nicola Compagni (Astronomy Dept., Bologna University, Italy), Barbara Lanzoni, Eugenio Carretta, and Flavio Fusi Pecci (INAF--Osservatorio Astronomico di Bologna), Giacomo Beccari (INAF--Osservatorio Astronomico di Bologna and Teramo), Raffaele Gratton and Sara Lucatello (INAF--Osservatorio Astronomico di Padova), Giampaolo Piotto (Astronomy Dept., Padua University, Italy), Elena Sabbi (Space Telescope Science Institute, USA), Robert T. Rood (University of Virginia, USA), Alison Sills (McMaster University, CA), and Sabine Moehler (Institute für Theoretische Physik und Astrophysik Kiel & ESO Germany).

### Notes

[1] 47 Tucanae (or 47 Tuc) is an impressive globular cluster that is visible with the unaided eye from the southern hemisphere. It was discovered in 1751 by the French astronomer Nicolas Louis de Lacaille who catalogued it in his list of southern nebulous objects. Located about 16 000 light years away, it has a total mass of about 1 million



times the mass of the Sun and is 120 light years across, making it appear on the sky as big as the full moon.

A striking image of the central parts of this cluster is available as ESO PR Photo 20/06.

[2] In the core of stars slightly more massive than the Sun, hydrogen is converted into helium using carbon, nitrogen and oxygen as ‘catalyst’.

###

A high-resolution image is available at <http://www.eso.org/outreach/press-rel/pr-2006/phot-37-06.html>

## Science Contact

### Francesco Ferraro

Astronomy Department

Bologna University, Italy

Phone: +39 051 2095774

Email: [francesco.ferraro3@unibo.it](mailto:francesco.ferraro3@unibo.it)

### National contacts for the media:

Belgium	Dr. Rodrigo Alvarez	+32 2 474 70 50	<a href="mailto:rodrigo.alvarez@oma.be">rodrigo.alvarez@oma.be</a>
Finland	Ms. Riitta Tirronen	+358 9 7748 8369	<a href="mailto:riitta.tirronen@aka.fi">riitta.tirronen@aka.fi</a>
Denmark	Dr. Michael Linden-Vørnle	+45 33 18 19 97	<a href="mailto:mykal@tycho.dk">mykal@tycho.dk</a>
France	Dr. Daniel Kunth	+33 1 44 32 80 85	<a href="mailto:kunth@iap.fr">kunth@iap.fr</a>
Germany	Dr. Jakob Staude	+49 6221 528229	<a href="mailto:staude@mpia.de">staude@mpia.de</a>
Italy	Dr. Leopoldo Benacchio	+39 347 230 2651	<a href="mailto:benacchio@inaf.it">benacchio@inaf.it</a>
The Netherlands	Ms. Marieke Baan	+31 20 525 74 80	<a href="mailto:mbaan@science.uva.nl">mbaan@science.uva.nl</a>
Portugal	Prof. Teresa Lago	+351 22 089 833	<a href="mailto:mtlago@astro.up.pt">mtlago@astro.up.pt</a>
Sweden	Dr. Jesper Sollerman	+46 8 55 37 85 54	<a href="mailto:jesper@astro.su.se">jesper@astro.su.se</a>
Switzerland	Dr. Martin Steinacher	+41 31 324 23 82	<a href="mailto:martin.steinacher@sbf.admin.ch">martin.steinacher@sbf.admin.ch</a>
United Kingdom	Mr. Peter Barratt	+44 1793 44 20 25	<a href="mailto:peter.barratt@pparc.ac.uk">peter.barratt@pparc.ac.uk</a>

ESO is the European Organisation for Astronomical Research in the Southern Hemisphere. Whilst the Headquarters are located in Garching near Munich, Germany, ESO operates three observational sites in the Chilean Atacama desert. The Very Large Telescope (VLT) is located on Paranal, a 2 600m high mountain south of Antofagasta. At La Silla, 600 km north of Santiago de Chile at 2 400m altitude, ESO operates several medium-sized optical telescopes. The third site is the 5 000m high Llano de Chajnantor, near San Pedro de Atacama. Here a new submillimetre telescope (APEX) is in operation, and a giant array of 12-m submillimetre antennas (ALMA) is under development. Over 1 600 proposals are made each year for the use of the ESO telescopes.

<http://www.eso.org>