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V605 Aql: 80 Years after the Final Helium Shell Flash

Geoffrey C. Clayton[1,2], J. M. Fedrow[2,3], P. A. Crowther[4], F. Kerber[5], N. Pirzkal[5,6] & O. De Marco[7]

[1]Department of Physics & Astronomy, Louisiana State University, Baton Rouge, LA 70803
email:gclayton@fenway.phys.lsu.edu
[2]Maria Mitchell Observatory, Maria Mitchell Association, 3 Vestal Street, Nantucket MA 02554
[3]The Evergreen State College, 2700 Evergreen Parkway NW, Olympia, Washington 98505
email:v605aql@yahoo.com
[4]Department of Physics & Astronomy, University of Sheffield, Hicks Building, Hounsfield Rd, Sheffield, S3 7RH, UK
email:paul.crowther@sheffield.ac.uk
[5]European Southern Observatory, Karl-Schwarzschild-Strae 2, D-85748 Garching, Germany
email:fkerber@eso.org
[6]STScI, 3700 San Martin Dr., Baltimore, MD 21218;
email:npirzkal@eso.org
[7]Department of Astrophysics, American Museum of Natural History, Central Park West at 79th Street, New York, NY 10024
email:orsola@amnh.org

Abstract. We have obtained new optical spectra with the ESO/VLT of the final helium flash star, V605 Aql. These spectra indicate that V605 Aql has evolved significantly in only 80 years. It now has a T_{eff} ∼95,000 K and has abundances similar to those seen in [WC] central stars but not to those of a typical RCB star.

Keywords. stars: evolution, abundances, AGB and post-AGB

1. Introduction

In 1996, Sakurai's Object (V4334 Sgr) was discovered undergoing a nova–like outburst (Nakano *et al.* 1996). Subsequent observations showed Sakurai's Object to be a star at the center of an old Planetary Nebula (PN) undergoing a final helium shell flash (FF). But this wasn't the first such outburst observed. In 1919, a very similar object, V605 Aquilae, was discovered (Wolf 1920). V605 Aql and Sakurai's Object seem to be twins (Duerbeck 2002), (Lechner & Kimeswenger 2004). So in the present state of evolution of V605 Aql, we may be seeing the not too distant future of Sakurai's Object.

The behavior of V605 Aql is very similar to that seen more recently in Sakurai's object. After a rapid brightening in 1996, followed by several fluctuations, Sakurai's object went into a deep decline in 1999 just as V605 Aql did in 1923 (Duerbeck 2002). Thick clouds of dust formed around both stars causing their precipitous declines. The spectrum of Sakurai's Object in March 1997 was very similar to the 1921 spectrum of V605 Aql (Kerber 2001). These spectra of both stars, obtained before they disappeared from view, show a great resemblance to a typical RCB star spectrum (Clayton & De Marco 1997). One difference is that Sakurai's Object shows significant ^{13}C (Asplund *et al.* 1999).

New optical spectra of V605 Aql were obtained on 2001 June 16, 18, 20 and 26 using FORS2 on the VLT-UT4. See Figure 1. A non-LTE radiative transfer model atmosphere was used to fit the spectrum. We used the approach of Crowther (2002) and Crowther *et al.* (2006). No abundances were derived for V605 Aql in 1921 but the abundances of

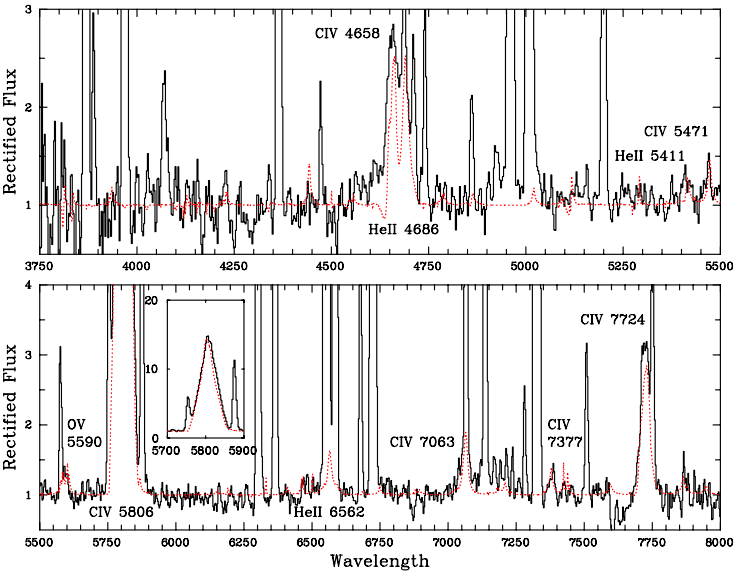

Figure 1. A new ESO VLT/FORS spectrum obtained in 2001 June of V605 Aql (black line). The spectrum has been normalized. Overplotted (dotted line) is the best-fit non-LTE radiative transfer model atmosphere. Only the broad stellar emission lines have been fit. The narrow emission lines are from the surrounding PN, A58.

Sakurai's Object in 1996 are quite similar to an RCB star with the exception of ^{13}C. And it is likely that the abundances of V605 Aql in 1921 were similar to those of Sakurai's Object in 1996. Yet, today, the V605 Aql abundances are quite different. It may be that the abundances of Sakurai's Object will continue to evolve over the next few years and become similar to those found for V605 Aql today. The abundance of V605 Aql today is consistent with being a [WC] star (C∼40%) whereas the abundances of Sakurai's Object are more like an RCB star (C∼6%). But there are a wide range of He and C abundances seen in the [WC] stars.

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