star formation rate up to the very early Universe. And just like quasars, they can be used to study the chemical composition of the inter-galactic medium. In several GRB afterglow spectra, multiple absorption systems have been detected through the identification of redshifted UV metal lines. When these GRBs were caught, they were typically fainter than R=20. With the launch of HETE–II (expected date of launch: 23 Jan. 2000), however, it will become possible to catch GRB afterglows when they are still very bright, at R ~15–16. This is due to the fact that HETE will be able to make an accurate position available immediately (less than one minute), whereas the WFC positions of *BeppoSAX* typically are available after 4 hours. At that brightness, high signal-to-noise, high resolution spectroscopy will become feasible. For some bursts it may even become possible to catch them when they are brighter than R=10, but this requires an automated activation procedure of the telescopes. ESO is already investigating the possibilities of automated activation of the VLT, and hopefully other observatories will follow.

Coming from cosmological distances, GRBs have the possibility of being gravitationally lensed. Although this possibility is estimated to be less than 0.1% (Blaes & Webster, 1992), with 3 bursts per day going off over the whole sky, detecting a lensed GRB is just a matter of time. With the clear variability that GRBs display, the time lag should be easy to determine, and assuming a mass model for the lensing galaxy or cluster, one will be able to estimate the value for H_0 (as has been done for several lensed variable quasars).

Following up GRB afterglows has pushed traditional ground-based observing into a new mode of operation — of frequent and substantial overrides. Thanks to the support of the time-allocation committees and observatory staff, and goodwill of the large majority of observers, this has actually worked very successfully. Without the target-of-opportunity possibility, many of the above mentioned exciting discoveries would not have been possible. Clearly, in the longer term, a move towards queue/reactive scheduling will benefit both GRB astronomers and the rest of the community.

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The Sakurai Object: A Case Study in Advanced Stellar Evolution

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In 1996 Y. Sakurai, a Japanese amateur astronomer, discovered what was originally described as a nova in Sagittarius. Spectroscopy soon after discovery indicated the Sakurai Object to have a cool hydrogen-deficient photosphere —quite unlike that of a normal nova explosion— and the only similar object being Nova Aql 1919 (Lundmark, 1921). With the detection of a faint and ancient planetary nebula around the star, it was clear that this was not like a typical nova but was probably a highly evolved single star undergoing some form of rather exotic evolution. In fact the Sakurai Object (now known as V4334 Sagittarii) has become one of the most intriguing objects in stellar astrophysics and promises to be a rosetta stone to our understanding of the evolution of ancient stars.

To understand why stellar astronomers were excited by Sakurai's discovery we must review some history. Hazard et al. (1980) discovered that the inner regions of the planetary nebula Abell 78 had material that strongly emitted [O III] and [N II] but emission from hydrogen was absent —the conclusion being that this object was hydrogen-deficient. Since then a number of other similar objects have been identified, the study of which, has led to new physics being developed —mass loading into a stellar wind (e.g. Hartquist et al., 1986), with application in many other branches of research. Theories developed to account for the odd physical properties of these systems and other hydrogen deficient stars, involved either merging binary white dwarfs (Webbink, 1984) or else a delayed helium shell flash (Iben et al., 1983). This later phenomena results from the small possibility that a shell flash (as experienced by stars ascending the AGB) may be delayed until the post-AGB star has almost become fully degenerate,

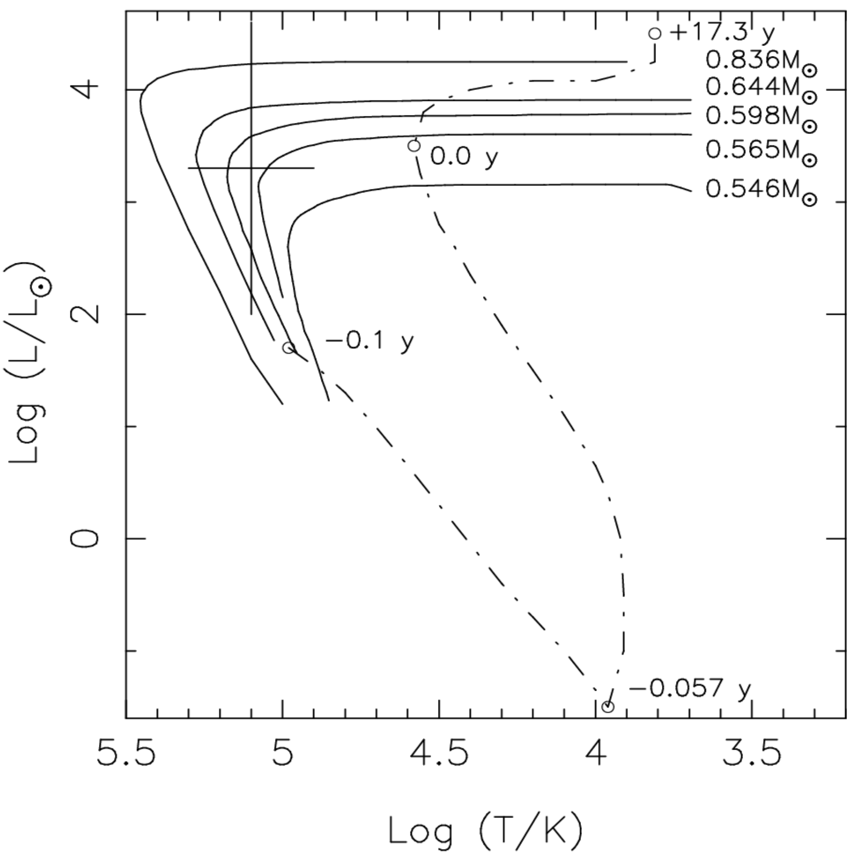

Figure 1. The position of the Sakurai Object prior to its shell flash derived from a model of the nebula ionisation (Pollacco, 1999). The solid lines are evolutionary tracks for post-AGB stars, while the broken lines represents the expected evolutionary track for a star suffering a helium shell flash. The Sakurai Object is currently positioned towards the top right of this diagram (high luminosity, and low temperature), but is heavily obscured by circumstellar dust.

albeit with a relatively massive envelope. Although exotic physics was necessary, it did seem that the strange abundance patterns produced by mixing during the shell flash could be related to the observed values (although the evolutionary timescales seemed far too short to explain some classes of hydrogen-deficient stars).

One of the hydrogen-deficient objects discovered is the central knot in Abell 58. Ford (1971) noted the apparent coincidence in position between this object and Nova Aql 1919 —a highly unusual, very slow nova. Although the nova has long since faded from view it had been given the designation V605 Aquila. However, Seitter (1987) obtained deep spectra of the central knot in Abell 58 and also found superimposed an extremely reddened continuum with V~22. The only features visible in her spectra were [C IV] 5801/11 Å emission, indicative of a strong wind and usually seen in Wolf-Rayet carbon stars. If the 1919 event was a shell flash then this object gives us the first indication of evolutionary timescales —less than 70 years from pre-white dwarf to red supergiant and back to hot central star!

So this is where the Sakurai Object fits in: it is the first observational test of this theory. In the 5 months following its discovery its surface abundance of hydrogen diminished by more than 0.7 dex and its temperature by several hundred degree's Kelvin per month. Furthermore, mixing of the envelope brought *s* process enhanced material to the surface (Asplund et al., 1999). During the first few months of 1997 the stellar temperature had diminished to the point where molecular (swan) bands had appeared and as dust formation started the whole photospheric spectrum became reddened and washed out. Evolution of the light curve resembled that of V605 Aql (as far as we can tell anyway) and eventually as massive amounts of dust were generated the object became heavily obscured in the optical (V~22), while it remains bright in the IR. All measurements taken over the last year suggest the photosphere/dust shell is still cooling. As for the future, we expect the similarity to V605 Aql to continue but with the benefit of modern detectors we will gain real insight to the rate and nature of evolution of the central star as it becomes hotter as well as the development of its wind and its interaction with its environment.

The Sakurai Object is the subject of an ongoing long-term monitoring campaign using the ING telescopes. The next few years promise much as it continues its evolution casting 'light' on many hitherto unobserved areas of evolution.

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