Radial-Velocity measurements of Blue Large Amplitude Pulsators (BLAPs)

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In 2017 the OGLE survey announced the discovery of large amplitude pulsations in faint blue stars.
There are now over 100 known `blue large amplitude pulsators' (BLAPs) with periods of 8 - 60 minutes, amplitudes up to 0.25 mag.
They are important because, like classical Cepheids, the periods of all radially pulsating stars directly tell us about their mean densities; their radial-velocity variations allow us to measure their radii.
They are interesting because they almost certainly have masses between 0.25 and 0.7 solar masses, with the low end favoured.
This poses interesting questions about their origin — suggestions include the stripped helium core of a low-mass red-giant, a helium-shell-burning hot subdwarf, the surviving remnant of a SN Ia, or the product of a double white dwarf merger. Quite likely several origins are possible.

They also pose interesting questions about pulsation physics - or at least our most recent models predict interesting phenomena that need to be investigated.
The pulsations need high opacities generated by the radiative levitation of iron-group elements, but such levitation might be suppressed by the pulsations.
The large amplitude of the pulsations results in shocks (and reverse shocks) which affect their light and velocity curves.
The phases of minimum radius and maximum light are correlated with mass and surface temperature.
The ratios of periods of different pulsation modes are quite different from those in Cepheids.
Hot and faint BLAPs are more likely to pulsating in the first overtone than the fundamental mode.
Multi-mode radial pulsations are possible.
Many of these predictions can only be tested and understood by measuring their radial-velocity curves.

We have proposed to use SALT to observe the RV curves for 9 BLAPs with a range of periods from 8 to 58 minutes.
The challenge is that all BLAPs are fainter than 15th magnitude, so that high-quality time-resolved spectroscopy requires a large aperture telescope.

This project will provide an opportunity for a student/postdoc to become involved, to learn how we reduce the time-resolved spectra and use them to measure radial velocities.
If appropriate, we will involve the project holder in the process of fitting model atmospheres to measure changes in effective temperature and surface gravity around the pulsation cycle,
or else to explore tests of one or more of the phenomena described above.
It is a time limited project, observations have been proposed for semester 2025-1, and we would like to process the data as soon as possible after observing for quality control.

The plan would be for a student/postdoc to visit Armagh, spending 4 - 8 weeks there to learn first-hand about our data reduction steps sometime during 2025, and apply them to data obtained during 2025-1 either during their visit or on return to SA.
Accommodation can be provided in Armagh, currently there is a cost of about £75 / week, but this is negotiable.