*Request for ZTF Collaborator Status - Daniel Perley*

This memo serves to request continuation of collaborator status for Daniel Perley (LJMU) within the following projects: (1) the bright transient survey and redshift completeness factor project (BTS/RCF), (2) superluminous supernovae, (3) fast transients. Participation in a supporting role for CLU, infant supernovae, SE-SNe, and TDEs/BHs (by contributing data and/or advice to these projects on a case-by-case basis), is also requested. Contributions to EM-GW follow-up are covered by the GROWTH MOU and not discussed below.

**Summary of major contributions to date:**

(1) Performed detailed re-development of the GROWTH Marshal filters for the RCF and SLSN programs, reducing the false-positive rate associated with stars, quasars, etc. by approximately an order of magnitude and reducing the associated scanning burden by several hours per week. Advised Anna Ho on changes/improvements to the fast-transients filter.

(2) Developed the RCF cross-check tool, which automatically compares the AMPEL and GROWTH lists and identifies any events that are "missing" from the GROWTH Marshal, after it was realized in mid-2019 that the Marshal is dropping candidates from all programs. Also developed a variety of other tools, including an automatically generated list of unclassified transients and an automatically generated and updated sample catalog.

(3) Performed the spectroscopic completeness analysis for the first RCF paper.

(4) Contributed Liverpool Telescope (LT) imaging and spectroscopy to a variety of programs, most crucially at early times to programs requiring an urgent response (prominent examples include 18abukavn, 19aayejww, and 19abvizsw) but also multi-color follow-up at later times and classifications for large numbers of other events.

(5) Developed the LRIS pipeline, enabling nearly-instant, hands-off reductions of imaging and spectra from all LRIS runs. During 2018/2019, continued to maintain and advise the pipeline, and perform reductions with it to support runs by Yan, Ho, and others.

(6) LJMU Ph.D. student Kirsty Taggart implemented an automatic triggering, reduction, and image-subtraction tool to enable the LT to be triggered from, and the resulting data automatically uploaded to, the GROWTH Marshal.

**Proposed contribution to ZTF key projects:**

Daniel Perley will continue to maintain and improve the GROWTH Marshal filters and other web resources for the BTS/RCF and SLSN projects. He will also continue to advise Anna Ho on improvements to the fast-transient filter and scanning system.

He will also continue to provide imaging and spectroscopic follow-up observations from the Liverpool Telescope to all projects (~150 hours/year for ZTF science): primarily RCF, SLSNe, and fast-transients, but also to other projects where requested by the relevant teams or via bright-time "filler" observations of generic ZTF targets. Data products will be uploaded to the GROWTH Marshal and made available to all collaboration members, in most cases within hours of being taken. Collaboration members will continue to be given the ability to trigger LT observations directly from the Marshal in support of these efforts.

He will also offer general expertise and interpretation, in particular regarding questions involving data reduction (LT/Keck), classification (SN subtypes, distinguishing SLSNe from TDEs/AGN), host galaxies, filter development, and survey completeness.

**Personnel:**

Participation is requested for Perley and for his PhD student (Kirsty Taggart). Taggart will help with SLSN scanning/selection and LT follow-up efforts, and continue to maintain and improve the LT reduction/subtraction pipeline and GROWTH Marshal interfaces. Taggart's expected graduation date is April 2020, and her status can be reviewed at that time depending on her post-graduation plans.

Perley has applied for funding support for a future postdoc, and it is envisioned that this postdoc would have some role in ZTF activities. If funding is approved the ZTF board will be consulted to establish appropriate guidelines for the recruited postdoc's role. Similarly, approval will be sought for any future students (which may include Bachelor's/Master's students and future PhD students).

**Observing Resources:**

Perley has institutional access to the Liverpool Telescope (LT), a 2-m fully robotic telescope at an excellent site. The LT offers ugriz imaging (to 23 mag in gri) with the IO:O camera, which is helpful for obtaining better photometric sampling for fast-evolving transients, obtaining color information to study temperature evolution, for following transients that have faded below the P48 limit, for source vetting, and for improved astrometry. It also offers robotic spectroscopy with SPRAT, providing similar sensitivity but higher resolution than SEDM. This is useful for obtaining classification spectra when P60 is unavailable, for obtaining time-resolved spectroscopy of rapidly-evolving young SNe, and for objects with narrow features washed out at SEDM resolution.

Perley will continue to assist with proposals at Swift, Gemini, VLA, SMA, ALMA, Keck/P200, ESO/VLT, HST, and other major resources. He will also apply for continued WHT time (WHT is being converted to a multi-object fiber spectroscopic survey facility but is still providing some time in classical modes).

Additionally, Perley will continue to maintain/upgrade the LRIS data reduction pipeline and update it in response to any future changes with the instrument.

**Point of Contact:**

The points of contact for these projects will be Lin Yan (SLSN) and Shri Kulkarni (fast transients, RCF).

**Proposed Publications:**

D. Perley plans to lead papers on ZTF19abvizsw (a fast transient found during GROWTH EM-GW follow-up) and on the first-18-month SLSN sample (filtering, selection, and classification) in early 2020. Perley, Taggart, or a future student/postdoc also plan to lead 1-2 additional papers relating to the RCF sample, likely on host galaxy properties or some aspect of supernova/transient demographics. Additional papers on individual objects of interest may be led on a case-by-base basis with approval of the relevant ZTF working group and publication board members.

**Required Access to ZTF Data:**

Access to relevant data associated with the above programs for D. Perley and K. Taggart is requested, along with knowledge of other follow-up efforts on these sources via the usual communication channels.

**Data Rights and Benefits:**

All imaging and spectra will be made available to the collaboration as detailed above. Standard co-authorship policies will apply; i.e. data or significant intellectual contributions provided towards a publication are expected to result in offered co-authorship.

**Timeframe:**

This MOU covers the time period until the end of ZTF Phase I.