Proposal for external collaboratorship by Gloria Sala

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Nova outbursts are explosive events resulting from a thermonuclear runaway in the H-rich envelope of an accreting white dwarf. Since the white dwarf is not disrupted by the event, accretion is resumed sometime after the outburst and the rebuilding of the H-rich envelope on the white dwarf leads to a new nova explosion at some point. Recurrence times range from 1 year to 10000 years. Nova events are in general discovered in the optical and followed in almost all wavelengths of the electromagnetic spectrum. X-ray emission arises during the outburst from shocks in the ejected shell, and a bright Supersoft X-ray Source (SSS) is often present for weeks or months after the outburst, powered by the H-rich burning white dwarf envelope (*Figure 1*).

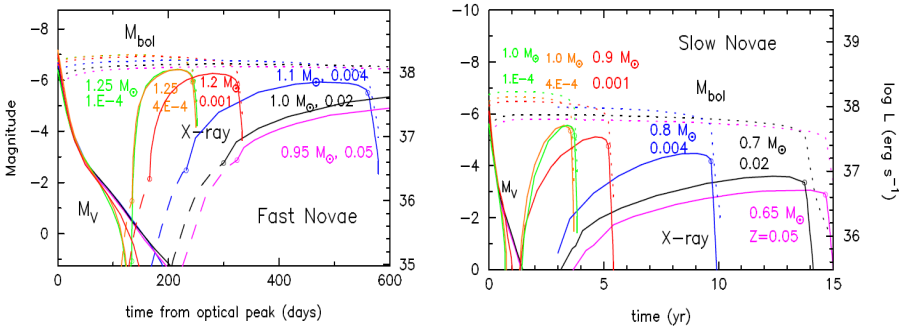

Figure 1: theoretical light-curves for fast and slow novae (Kato et al 2013 ApJ 779, 19). Note that time scale is shown in days for fast novae and in years for slow novae. Solid lines show absolute magnitude Mv and X-ray flux for several white dwarf mass

While novae are usually first discovered in the optical, in some particularly crowded fields, the bright SSS arising some weeks after the optical outburst makes them easier to detect in the X-ray than in the optical. That is the case in Globular Clusters, where novae are seldom detected. Only three nova detections have been confirmed in GCs of M31 (*Henze et al. 2009 A&A 500, 769 and 2013, A&A 549, 120*), but no confirmed detection has been reported for Galactic GCs (the only candidate dates back to 1860). This may be due to a selection effect: GCs are densely populated environments where the optical contrast of a nova in outburst is small, and thus difficult to detect by amateur astronomers, usual discoverers of Galactic novae. However, there are many known cataclysmic variables in GCs and no reason that should hinder the nova outbursts to occur. Besides, the study of novae in GCs would be of particular interest since the metallicity of the accreted material, which plays a crucial role in the physics of the explosion, could be constrained in the fixed metallicity environment of a GCs. Study of novae in low metallicity environments is essential to confirm the differences in the properties of the outburst and the outcome of newly synthesized elements predicted by theoretical models, as well as its role in the Galactic chemical evolution (*José et al 2007, ApJ 662, L103).*

The bright SSS emission of the nova in outburst makes novae in GCs more easily detectable in the X-rays than in the optical. I propose to make use of the eROSITA data of GCs during the survey to search for SSSs that point to a recent nova outburst. The project would combine weekly observations in the optical three months before eROSITA visits to each GCs to be able to correlate possible new SSS with optical novae. The schedule is adapted to the expected optical/X-ray evolution of novae (see Figure 1). Observations will be performed in the North from the 1.0m Joan Oró Telescope in the Montsec Astronomical Observatory in the Pyrenees (http://www.ieec.cat/en/content/206/what-s-the-oadm; proposal p295 for 2020B, see test GC image in *Figure 2*) and in the South from the 0.6m Boller & Chivens Telescope in Pico dos Días in Brazil (http://www.lna.br/opd/opd_e.html; proposal 1822 for 2020B; proposals submitted to low-pressure calls for both observatories). The nova search in the optical will be performed in the optical using a modified version of the pipeline developed for the Montsec observations included in the projects of nova monitoring in M31 and M81 since 2009 (http://www.mpe.mpg.de/~m31novae/index.php?lang=en).

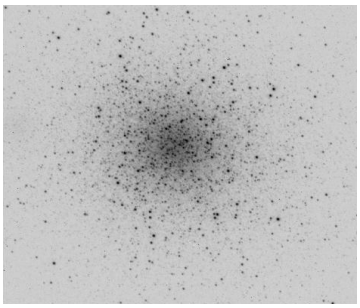

Figure 2: NGC6205 observed from the Joan Oró Telescope, R, 200 sec.

Our optical monitoring of Globular Cluster will be also available for other science cases. In addition to our weekly monitoring, the schedule policy of the observatories is somewhat flexible and it could be modified for follow-up of particularly interesting transients discovered with eROSITA in Globular Clusters.

-- *potential collaborators:* Frank Haberl, Axel Schwope, Jochen Greiner, Hauke Worpel

-- *possible/expected outcome in terms of publications, catalogs, resources:* At least one publication with the correlations of SSS in GCs and optical novae is expected; other publications possible if correlations are found for other transients.