Case Study of Data Mining in Observational Astronomy: The Search for New OB Stars in the Small Magellanic Cloud

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OB stars are the most luminous and massive stars, living short lives and exerting a disproportionate influence on their environments. They are key to understanding progenitors of gravitational wave sources and reionization of the early Universe. To detect new OB stars, my novel project combines photometric catalog data with TLUSTY and ATLAS9 stellar atmospheres. This method is the first sensitive to elusive “stripped” stars, thought to lose their hydrogen envelope through binary interaction. To investigate these stars, I also computed 2 grids of new models for OB and “stripped” stars across a range of temperatures, luminosities and helium abundances using CMFGEN. OB stars are intrinsically luminous, so complete populations are assumed for local group galaxies such as the Small Magellanic Cloud (SMC). My findings challenge this, as I found 26 new OB candidates. Compared to the accepted number of ~ 270 in the SMC, this is an increase of up to 10%. Spectroscopy of 7 candidates shows a 100% detection rate, including a rare B[e] star showing variable emission over 10 minute timescales. Most interestingly, 5 of my candidates are consistent with “stripped” stars. To date only 5 candidates have been found serendipitously (e.g. HD 45166) as current methods are not sensitive to them. My project doubles the sample of detected candidates, highlighting that my approach is the first ever to find them in a targeted, systematic way. The finding of “stripped” stars could rewrite our understanding of the early Universe, offering an alternative hypothesis to Wolf-Rayet driven cosmic reionization.

Awards Won:
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