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Cecilia Payne-Gaposchkin Doctoral Dissertation Award in Astrophysics Finalist (2021): Fast radio burst detection and morphology with the CHIME telescope

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Fast radio bursts (FRBs) are millisecond extragalactic radio transients of elusive origin that were first discovered in 2007. Some FRBs repeat and some apparently do not, even after hundreds of hours of follow-up observations. In order to unravel the origin of FRBs we have to detect a large population of them, ideally with one instrument. In my thesis, I have shown how to set up a real-time survey for FRBs with a novel telescope that does exactly that: the CHIME/FRB experiment. I have contributed significantly to the development of the hardware systems, the real-time and offline data pipelines. I show how to automatically associate events detected by CHIME/FRB with known sources of radio transients. We have detected 18 new repeating sources of FRBs and I characterize their burst morphologies, in order to understand better how they are emitted and how their signal has propagated through the interstellar medium. Finally, I show how to differentiate between one-off FRBs and repeating sources by way of their burst morphologies. I confirm that repeater bursts, on average, have larger widths and I show, for the first time, that repeater bursts, on average, are narrower in bandwidth.