論文審査の結果の要旨

氏名 オマンド コナー マイケル ブルース

Committee members included myself (Kipp Cannon), 浅野勝晃, 高田昌広, 戸谷友則, and 山本智.

Mr. Omand's thesis presents a model of the electromagnetic emissions of a pulsar wind-driven nebula in the period following the death of the progenitor star. In particular, the model is proposed as an emission mechanism for type I super-luminous supernovæ (SLSN-I). The thesis computes the spectrum and time dependence in radio and millimetre bands and makes predictions for observations to be carried out using the Jansky VLA and ALMA observatories, respectively. VLA observations of 10 SLSNe-I remnants at 3GHz are presented and compared to the model. 9 are null results, 1 shows a detection. The null results show tensions with the model and are interpreted to mean that at least some of these sources cannot be due to the proposed emission model. The model, the observations, and the interpretation are all novel results. Examples of some results are shown in the future below, which has been taken from Mr. Omand's thesis

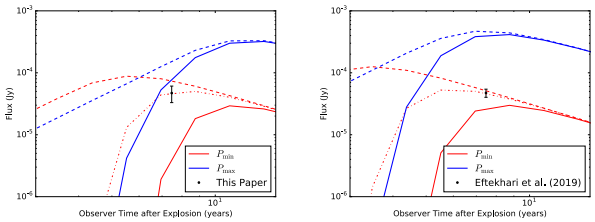

FIGURE 3.2: The detected 3 GHz (left panel; this paper) and 6 GHz (right panel; Eftekhari et al. 2019) flux densities for PTF10hgi with 1σ uncertainties shown in black. The $P_{\rm min}$ and $P_{\rm max}$ models from Table 3.3 are shown in red and blue respectively, with solid lines indicating the light curve with ejecta absorption and dashed lines indicating the curve without ejecta absorption. We find that a $P_{\rm min}$ model where 30-50% of the ejecta is singly ionized and the rest is neutral can reproduce the observed data; the dash-dotted red line indicates a $P_{\rm min}$ model where 40% of the ejecta is singly ionized.

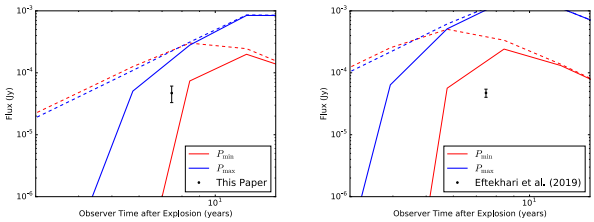

FIGURE 3.3: The same as Figure 3.2, but with $\gamma_b = 10^2$ instead of 10^5 and with no models that have partially ionized ejecta.

Altogether the work has been conducted in collaboration with a large number of other researchers, for example those conducting the observations. Mr. Omand's specific contributions have been identified in the thesis, and consent forms for publication of the work have been obtained from all collaborators.

Following Mr. Omand's revisions to the manuscript, which we requested and have reviewed, the committee recommends that a doctoral degree be awarded.