Supersoft X-ray Phase of Single Degenerate Type Ia Supernova Progenitors in Early Type Galaxies

Izumi Hachisu (Univ. of Tokyo), Mariko Kato (Keio Univ.), Ken'ichi Nomoto (Univ. of Tokyo)

(Submitted on 28 Oct 2010)

In the single degenerate (SD) scenario for Type Ia supernova (SN Ia) progenitors, an accreting white dwarf (WD) is expected to undergo a supersoft X-ray source (SSS) phase. Recently, Gilfanov & Bogdan (2010, hereafter GB10) claimed that observed X-ray fluxes of early type galaxies would be too low to be consistent with the prediction of the SD scenario based on rather simple assumptions. We present realistic evolutionary models of SD systems and calculate durations of SSS phases. In most cases, accreting WDs spend a large fraction of time in the optically thick wind phase and the recurrent nova phase rather than the SSS phase. Thus the SSS phase lasts only for a few hundred thousand years. This is by a factor of ~10 shorter than those adopted by GB10 where the SN~Ia progenitor WD was assumed to spend most of its life as a SSS. The theoretical X-ray luminosity of the SSS has a large uncertainty because of the uncertain atmospheric model of mass-accreting WDs and absorption of soft X-rays by the companion star's cool wind material. We thus adopt an average of the observed fluxes of existing symbiotic SSSs, i.e., ~0.4 x 10^{36} erg s^{-1} for 0.3--0.7 keV. Using these SSS duration and soft X-ray luminosity, we show that the observed X-ray flux obtained by GB10 is rather consistent with our estimated flux in early type galaxies based on the SD scenario. This is a strong support for the SD scenario as a main-contributor of SNe Ia in early type galaxies.

Comments: 5 pages, 3 figures, to appear in ApJL
Subjects: **High Energy Astrophysical Phenomena (astro-ph.HE)**
Cite as: **arXiv:1010.5860v1 [astro-ph.HE]**

Submission history

From: Izumi Hachisu [view email]
[v1] Thu, 28 Oct 2010 04:54:51 GMT (31kb)

Which authors of this paper are endorsers?