Wolf-Rayet Phenomena in Massive Stars and Starburst Galaxies
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Non-thermal high-energy emission from Galactic Wolf-Rayet stars?

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Abstract. We have updated the list of promising candidates for observations of *non-thermal* high-energy emission from Galactic Wolf-Rayet stars with present and future X/γ-ray instruments.

1. Introduction

Theory predicts *non-thermal* X-ray and γ-ray continuum emission from winds of luminous massive stars (singles as well as binaries) through at least one of the following three major radiation mechanisms: inverse-Compton scattering of the stellar UV photons by relativistic electrons (Chen & White 1991a,b); *Bremsstrahlung* radiation from collisions between electrons and thermal ions (*e.g.*, Pollock 1987a); and π°-decay with the neutral pions produced as an important secondary in ion-ion interactions (White & Chen 1992). Evidence for the existence of such (pre-requisite) high-energy particle populations stems from the observation of a strong and often variable non-thermal *radio* component in a number of Wolf-Rayet stars (*e.g.*, Chapman *et al.* 1999) which is thought to be synchrotron radiation of relativistic electrons accelerated via the first-order Fermi mechanism in strong shocks (White 1985). However, building high-energy source models on stellar wind particle acceleration remains rather speculative before a clear observational proof is found also at X/γ-ray energies!

2. Promising non-thermal candidates sources

It follows from the above and work on dust formation in the environment of WC stars (*e.g.*, Usov 1991; Williams in these Proceedings) that (necessary?) criteria to be fulfilled by promising candidates for the detection of non-thermal emission at high energy are: (variable) non-thermal radio emission (NT); excess X-ray flux (eX); and episodic/periodic dust formation (IR) (Table 1), as pointed out earlier by van der Hucht (1992). All these phenomena are best met within the model of colliding winds in a long-period binary system for which WR 140 (HD 193793) is the prototype among the WR stars (Williams *et al.* 1990).
Note: At the time of this symposium there seems to be growing evidence for non-thermal X-ray emission of WR 140 in its pre-periastron phase from semi-annual *ASCA* observations (Corcoran *et al.* these Proceedings), as preluded already by *EXOSAT* observations (Williams *et al.* 1990).

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Table 1. List of (the most?) promising non-thermal candidates sources

WR	spectral type	gal. coordinates l (°)	b (°)	criterion	reference(s)
6	WN4b (SB1)	234.76	−10.08	(variable X)	WS96,SIN98
11	WC8+O8.5III	262.80	−7.69	NT: / (var. X)	CLK99/WSS95,SCW96
14	WC7	267.55	−1.64	NT	CLK99
19	WC5+O9.5-7	283.89	−1.19	IR	W97,VHW98
22	WN7ha+O7.5	287.17	−0.85	eX	P87b
25	WN6ha+O4?	287.51	−0.71	eX	P87b
39	WC7	290.63	−0.90	NT	CLK99
48	WC6+O9.5I	304.67	−2.49	NT	CLK99
48a	WC8	305.37	+0.07	IR	W97
70	WC9+B0I	322.34	−1.81	IR	W97
90	WC7	343.16	−4.76	NT	CLK99
97	WN5b+O7	354.68	−1.12	eX	P87b
98	WN8o/WC7	355.21	−0.87	NT:	ABCT86
98a	WC9	358.13	−0.03	IR	W97
103	WC9 (SB1?)	358.48	−4.89	('dusty' WC)	VGH98
104	WC9+B0.5V	6.44	−0.49	('dusty' WC)	C97
105	WN9h	6.52	−0.52	NT	CLK99
112	WC9	12.15	−1.19	NT	CLK99
113	WC8+O8-9IV	18.91	+1.75	('dusty' WC)	VGH98
121	WC9	28.73	−0.13	('dusty' WC)	VGH98
125	WC7+O9III	54.44	+1.06	NT / eX / IR	CLK99/P87b/W97
137	WC7+OB	74.33	+1.09	IR	W97
139	WN5o+O6	76.60	+1.43	(variable X)	CSP96, MKY99
140	WC7+O4-5	80.93	+4.18	NT / eX / IR	P87b/W90/W97/CLK99
144	WC4	80.04	+0.93	NT:	ABCT86
145	WN7o/WCE+OB?	79.69	+0.66	eX	P87b
146	WC5+O8.5V	80.56	+0.45	NT	CLK99
147	WN8(h)+B0.5V	79.85	−0.32	NT	CLK99

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