STELLAR WINDS FROM MASSIVE STARS: THE INFLUENCE OF X-RAYS ON THE DYNAMICS

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ABSTRACT. We report on a theoretical investigation of the X-rays observed from early type stars on the global wind dynamics.

1. Introduction

X-rays are observed from early type stars with \( L_x \sim 10^{31} - 10^{34} \) erg s⁻¹, and are believed to be produced from shocks in the wind. The wind model of Castor et al. (1975, CAK), and subsequent modifications, remains the most realistic and complete description of line driven winds. Here, we use a modified CAK model which includes the effects of X-ray ionization (XRI) on the force multiplier \( M(t) \), and some simple estimates about the distribution of X-rays in the wind to investigate the dynamical impact of the X-rays. The model has been previously used to investigate gas dynamics in MXRB's (Stevens and Kallman, 1990).

2. Results

- For values of \( \log_{10} P \geq 21.5 \) \( (P = L_x v_\infty / \dot{M}) \) major changes in wind dynamics can occur.
- \( \dot{M} \) is largely unchanged by XRI, while \( v_\infty \) tends to be reduced; by \( \sim 50\% \) for higher values of \( P \).
- The observed parameters suggest that for a number of early type stars XRI can alter the wind dynamics.
- Stars most likely to be dynamically affected by XRI are those with relatively high values of \( L_x / L_{bol} \sim 10^{-6} \) (Chlebowski et al. 1989).
- In most WR stars XRI will not significantly alter the wind dynamics.
- However, some WR stars might be affected, particularly those with higher X-ray luminosities such as HD 93162, HD 193793, and HD 104994, though in these stars it is possible other mechanisms are at work (colliding winds, wind-ISM interactions).

References


K. A. van der Hucht and B. Hidayat (eds.),
Wolf-Rayet Stars and Interrelations with Other Massive Stars in Galaxies, 318.
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