

# Bow shocks, bow waves, and dust waves. V. No dust wave for $\sigma$ Ori

William J. Henney & S. Jane Arthur

*Instituto de Radioastronomía y Astrofísica, Universidad Nacional Autónoma de México, Apartado Postal 3-72, 58090 Morelia, Michoacán, México*

Accepted XXX. Received YYY; in original form ZZZ

## ABSTRACT

We critically evaluate the role of radiation and hydrodynamics in providing internal support for the bow-shaped infrared arc around the massive triple star system  $\sigma$  Ori Aa/Ab/B in the IC434 H II region. We present evidence for hydrogen recombination line emission from the arc, which demonstrates that it cannot be a decoupled dust wave, as has previously been claimed. On the other hand, we show that the fraction of the stellar luminosity trapped by the arc is insufficient for it to be supported by radiation if the grains and gas are well coupled. Therefore, the arc must be supported by the ram pressure of an internal wind. However, the stellar winds from the OB stars in the  $\sigma$  Ori Aa/Ab/B system seem too weak to provide this support on their own. We propose instead that it is the photoevaporated disk wind from the enclosed proplyd IRS 1B that dominates the ram pressure support for the bow.

**Key words:** circumstellar matter – radiation: dynamics – stars: winds, outflows

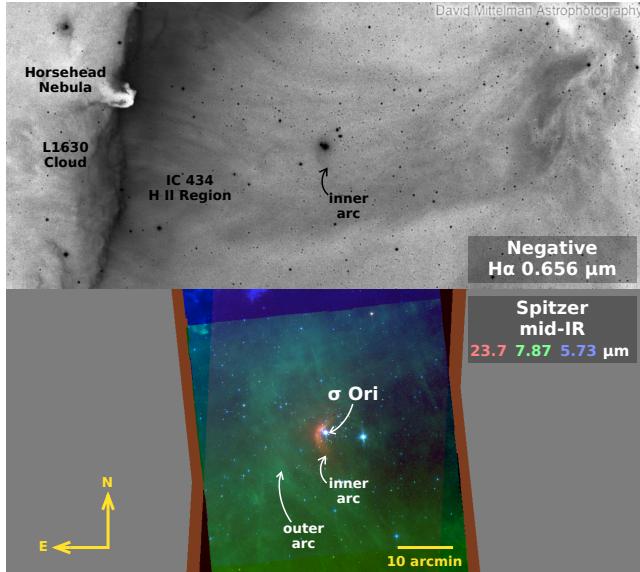


Figure 1. Optical and infrared images of  $\sigma$  Ori

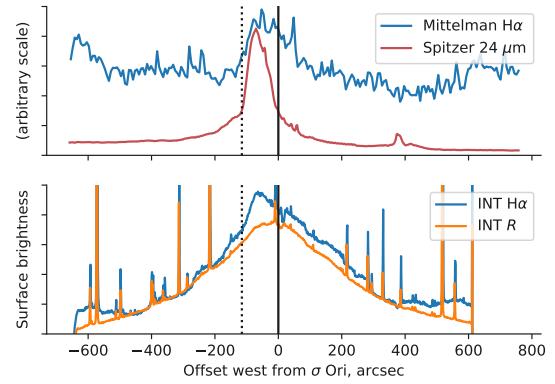


Figure 2. Brightness profiles through  $\sigma$  Ori inner arc.

## 1 WHY THE INNER ARC CANNOT BE A DECOUPLED DUST WAVE

## 2 WHY THE INNER ARC CANNOT BE RADIATION-SUPPORTED

SEDs of the two arcs

## 3 WEAK STELLAR WINDS FROM THE MASSIVE TRIPLE AA/AB/B

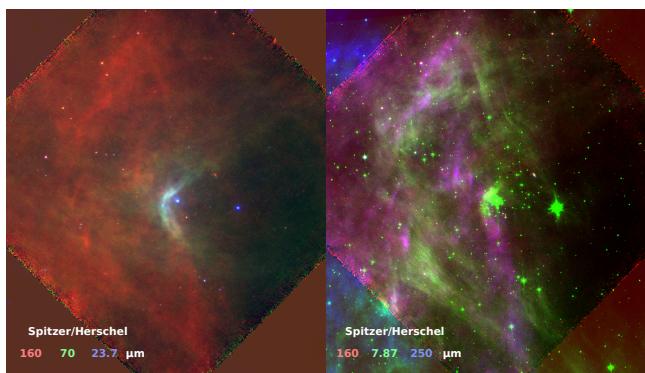
## 4 PHOTOEVAPORATION FLOW FROM THE PROPLYD IRS 1B

## 5 THE NATURE OF THE OUTER DUST ARC

## 6 CONCLUSIONS

## REFERENCES

This paper has been typeset from a T<sub>E</sub>X/L<sup>A</sup>T<sub>E</sub>X file prepared by the author.



**Figure 3.** Combined mid-infrared and far-infrared views of the inner and outer arcs around  $\sigma$  Ori

**Figure 4.** Spectral energy distributions of arcs around  $\sigma$  Ori