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# OUTFLOWS FROM YOUNG STELLAR OBJECTS AND POST-AGB STARS

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**We present a comparison of outflows between a young stellar object (HH 240/241) and a post-AGB star (CRL 618). The outflows of these objects are narrow and similar in morphology, indicating that they may be driven by similar, but unseen, fast, collimated winds ejected from the central sources. We also present a simple, hydrodynamical simulation of a fast, collimated wind and compare it to the observations. We find that a fast, collimated wind with a small opening angle can indeed produce a narrow lobe similar to that of HH 240/241 and CRL 618.**

Fast, collimated outflows are found in both young stellar objects (YSOs) and post-asymptotic giant branch (AGB) stars. They indicate that mass is ejected violently into the ambient material as stars form and die. They are a record of the mass-loss history and provide crucial diagnostics of the mass-ejection mechanisms in forming and dying stars.

There are similarities in the outflow morphology between forming and dying stars. Figure 1 presents the observations of HH 240/241 (YSO) and CRL 618 (protoplanetary nebulae). The two outflows both show (1) highly collimated outflow lobes (note: CRL 618 has multipolar ejections at different directions, probably associated with a binary source), (2) shell structures around the outflow axis, and (3) a series of bow-like structures along the outflow axis.

These highly collimated outflows are likely to be produced by similar fast, collimated winds ejected from the central sources. Figure 2 presents a hydrodynamical simulation of a fast, collimated wind interacting with a spherical ambient material. As can be seen from the figure, a fast wind with a small opening angle can readily produce a highly collimated lobe similar to that of HH 241/241 and CRL 618.

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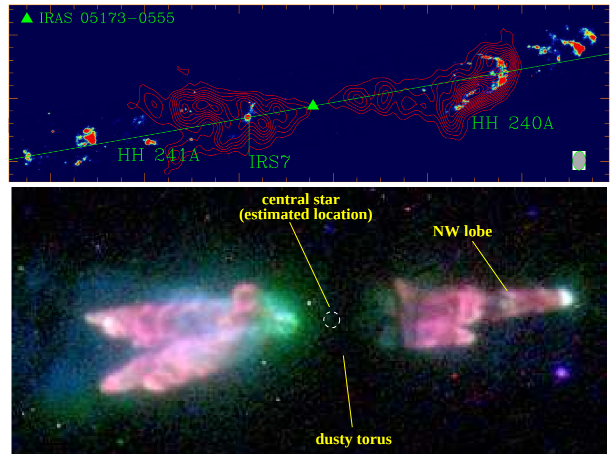


Fig. 1. The upper panel shows the CO contours on top of a $H_2$ image of HH 240/241 (from Lee et al. 2000). The lower panel shows the [O I] $\lambda$6300 Å+H$\alpha$ emission of CRL 618 (from Sahai 2003). NOTE: THIS FIGURE IS AVAILABLE IN COLOR IN THE ELECTRONIC VERSION OF THIS ARTICLE, OBTAINABLE FROM `http://www.astroscu.unam.mx/~rmaa/`.

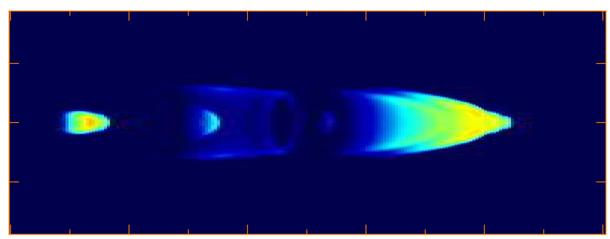

Fig. 2. Hydrodynimcal simulation of a fast, collimated wind interacting with a spherical ambient medium (Lee & Sahai 2003). This figure shows the [O I] $\lambda$6300 Å emission derived from the simulation. The fast wind has an opening angle of 10° and a period of variation in velocity and density of 22 years.

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## REFERENCES

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