Expansion in the Planetary Nebula NGC 6302

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During the final stage of stellar evolution a star ejects its outer envelope, accelerates it, and eventually ionizes it, forming planetary nebula. At this stage the expelled gas shines brightly, often forming distinguishable sub-structures in its earlier outflows. By tracing the expansion of these structures we obtain a direct insight into the velocity field of the planetary nebula. Meaburn et al. (2002) applied the same technique to the outermost parts of NGC 6302, using two observations separated by 50 years. We compared HST images of NGC 6302 from two epochs separated by ~10 years to look for movement of the gas. We present work which attempts to reproduce the velocity field in the innermost regions of NGC 6302.
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MOTIVATION: Planetary Nebulae represent one of the fastest evolving astronomical objects. The majority of the stellar mass has been released at the termination of the AGB phase. We don’t know exactly when and how, although it seems that this release of mass happens in a short period around the time of the initial mass loss. Thus the inquiry of the original AGB supernova is tied in with understanding the proper motion field in the inner part of the nebula.

OBSERVATIONS: This work is based on two observations with the Hubble Space Telescope. The first one was taken with WFPC2 on 21-02-2000 with F656N & F658N filters and the second on 27-07-2009 with WFC3 in F658N filter. The data cover a period of close to 9.5 years. This time span was chosen to allow for the proper motions of the structures in the nebula to be seen clearly (see figure 3).

METHOD: Using the Montage software we matched the pixel scale, orientation and zero points of the images. Later we defined 40+ regions with distinguished nebular structures typically 30x30 pixels, and cross correlate them using IDL astrolib. The peak of the cross correlation function was fitted with 2D Gaussian profile. Measured shifts were typically below two pixels.

CONCLUSIONS: - We demonstrated feasibility of direct measurement of the velocity field in the inner part of the nebula. - Our measurements suggest that the lobes of the nebula are still opening.