

## Preliminary Observation of Asymmetrical Morphology of Crab Nebula

This study shows the development of the asymmetry of the Crab Nebula through the years and the rate of its expansion in visible wavelength taken by the Hubble Space Telescope. The Rayleigh-Taylor instability is mainly accountable for the existing visible optical filaments which shows the nebula's asymmetric development is increasing. Images were processed by isolating into quarter sections labeled as NW, SW, NE, and SE. A 3-Dimensional axis scatter plot diagram of RGB pixel values represents data that displays the variances in each region to illustrate asymmetry to observe its rate of expansion. The concentration of the blue filaments (O iii) is close to the center of the Crab Nebula since that area makes elements energized or excited. The green filaments (S ii) is in between the outer and the inner part of the Crab Nebula, is also the same results in the comparative model computations could be due to the weak H $\beta$  in the [S iii]/H $\beta$  ratios of which has a relatively high sulfur concentration in the southeast edge filaments. The recognized expansion of the Crab Nebula from 2012 is  $R_{exp} = 0.135 \pm 0.005$  percent yr<sup>-1</sup> that is significantly larger than the last expansion rate of the Crab Nebula by  $RPWN \propto t^{1.264 \pm 0.049}$ , which initially thought that the Crab Nebula has an asymmetrical shape is due to the difference in the number of filaments, but the results show otherwise, the filaments in different regions are almost the same, it just varies in the density of filaments in different areas. This indicates that the Crab Nebula has different rates of expansion, different temperatures, and different distribution of atoms in a different region that causes its asymmetry.

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