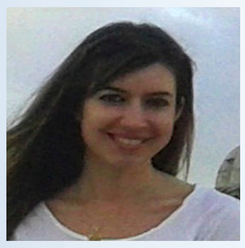

sophia.derlopa@noa.gr

The first 3D morpho-kinematical model of a Supernova Remnant: The case of VRO 42.05.01

Sophia Derlopa[1,2] , Panos Boumis[1] , Alexandros Chiotellis[1] , Wolfgang Steffen[3] , Stavros Akras[4]
[1]*IAASARS, National Observatory of Athens, Greece*
[2]*Department of Physics, University of Athens, Greece*
[3]*Instituto de Astronomia, UNAM, Ensenada, B.C., Mexico*
[4]*Universidade Federal do Rio Grande, Brazil*

Abstract

We present preliminary results of the first 3D morpho-kinematical model of a Supernova Remnant (SNR). As a study case we used the SNR VRO 42.05.01 (hereafter VRO). For the interpretation of its intriguing morphology we adopt the scenario of the interaction of the Supernova ejecta with the wind-bubble created from a supersonically moving Wolf-Rayet star (see poster 10.4 in this conference). We used the morpho-kinematical code "SHAPE" [1] on which we applied optical imaging data and high-resolution long slit echelle spectroscopical data (see [2] and poster 10.3). The model is consisted of three basic structures: the shell, the wing and the hat (see Fig. 1b). Our basic "guide" for the 3D reproduction of VRO's morphology, was the agreement between the synthetic Position Velocity (PV) diagrams produced with "SHAPE" and the observational PVs obtained from the echelle spectra. The first deduced results of our model are in sufficient agreement with the overall shape of VRO, providing by this way morpho-kinematical information in the third direction.

Preliminary Results

- *The western part of the wing is titled with respect to its eastern counterpart, which accounts for the diformation of the wing morphology.*
- *The shell shows an expansion velocity of $V_{exp.}$~80-100 km s^{-1}, while the wing has $V_{exp.}$~40-60 km s^{-1}. This difference in their kinematical properties is probably due to ambient medium density variations in these two regions.*
- *The hat appears to have $V_{exp.}$~80-100 km s^{-1}, and the upper part of the shell (see Fig.2, green part) has V_{exp}~180-200 km s^{-1}, which is higher than the rest shell. This is probably due to a shock breakout from the wind-bubble in these two edges of the remnant.*
- *Our best fit model is achieved considering an inclination of ~ 6-8°, with the shell being directed inwards the page, while the wing and the hat outwards the page.*
- *The adopted radial systemic velocity of the SNR for our best fit model, is Vsyst ~ -15 to -20 km s^{-1}.*

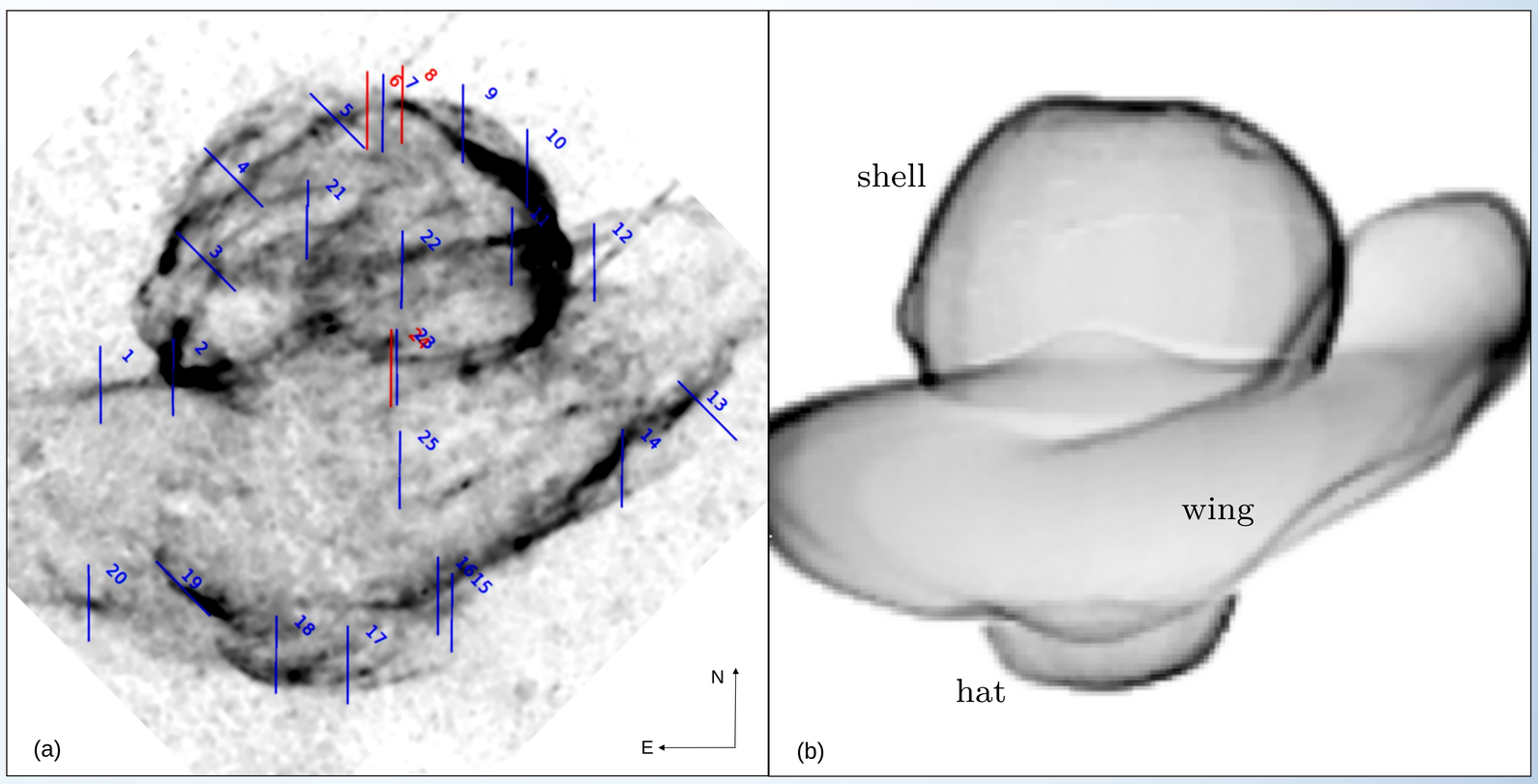

Fig. 1: (a) The Hα image of VRO along with the labelled positions where long-slit echelle spectra have been taken (see [2] and poster 10.3). (b) The result of the 3D modelling of VRO created with the code "SHAPE".

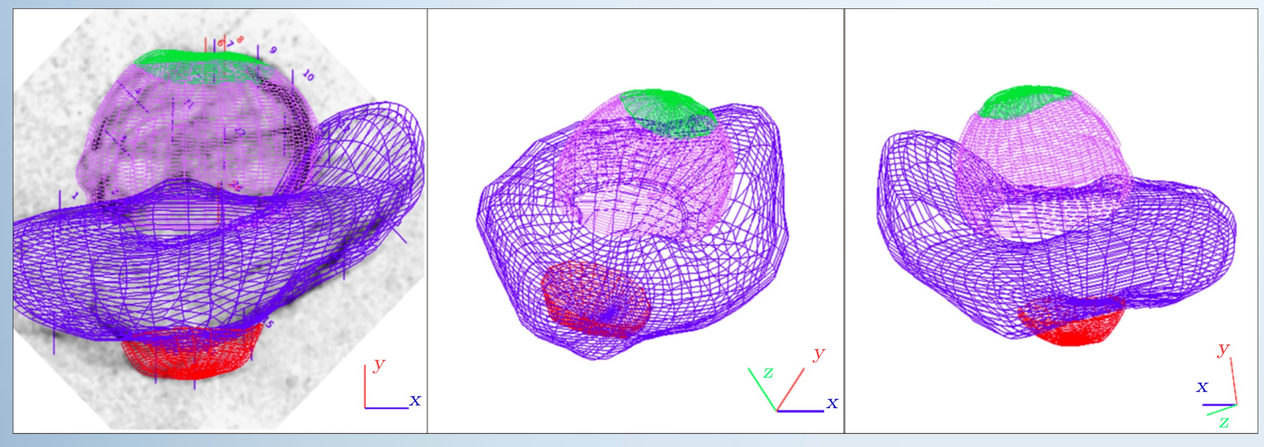

Fig. 2: The 3D model of VRO produced with "SHAPE" in mesh grid illustration, as viewed from different angles.

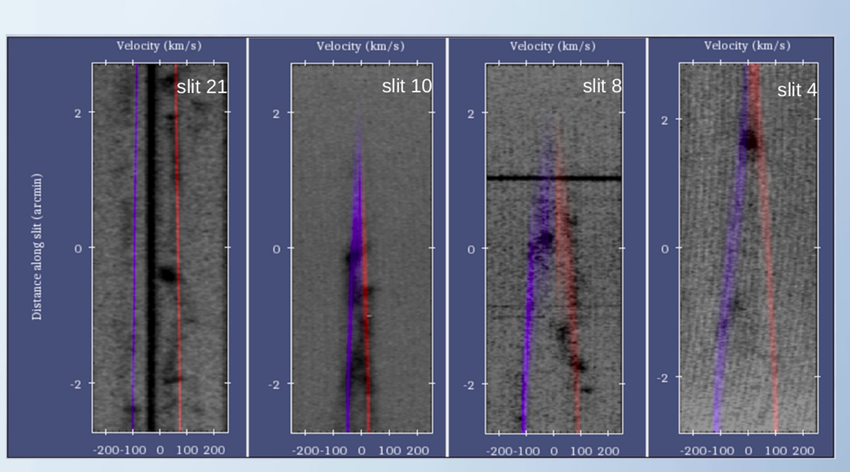

Fig. 3: Observational PV diagrams of selected areas of VRO (in black), along with the synthetic PVs (blue/red) created with "SHAPE". The plots are calibrated in $V_{heliocentric.}$

References:

[1] Steffen W., Koning N., Wenger S., Morisset C., Magnor M., 2011, IEEE Transactions on Visualization and Computer Graphics, Volume 17, Issue 4, p.454-465, 17, 454
[2] Boumis, P.; Akras, S.; Leonidaki, I.; Chiotellis, A.; Kopsacheili, M.; Alikakos, J.; Nanouris, N.; Mavromatakis, F. , 2016sros.confE..15B